EMOTE CONTROLLER FOR GARAGE DOORS

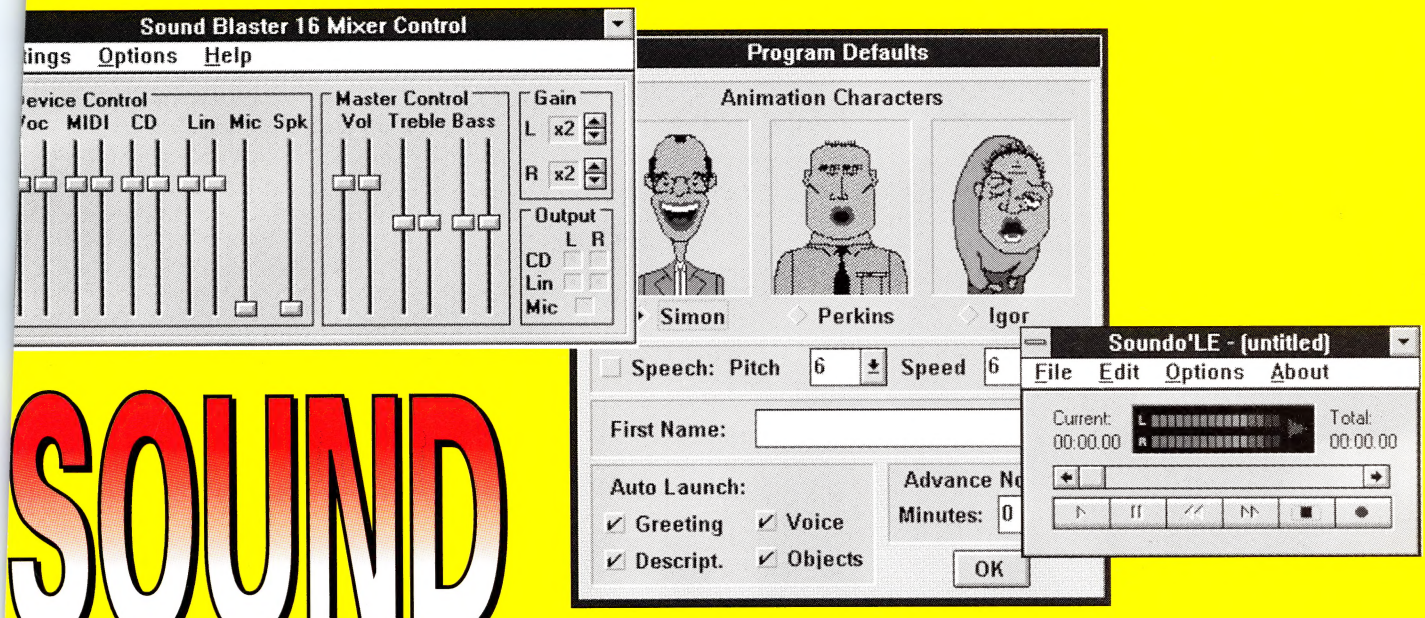
SILICON CHIP

NET 241193
BRENTFORD SQ
NEWS 878-1882
1 $4.50

$4.50 DECEMBER 1993
NZ $5.95 INCL GST

AUSTRALIA'S DYNAMIC ELECTRONICS MAGAZINE

RVICING – VINTAGE RADIO – COMPUTERS – AMATEUR RADIO – PROJECTS TO BUILD



SOUND BLASTER

16-BIT CD-QUALITY STEREO SOUND FOR YOUR PC

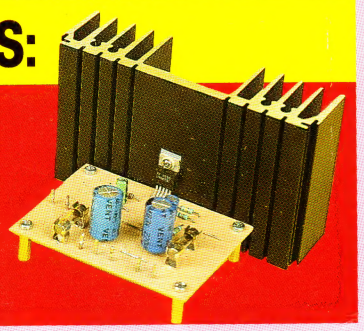
LED STROBOSCOPE WITH DIGITAL READ-OUT

ELECTRONIC ENGINE MANAGEMENT: CHANGING THE SOFTWARE

BUILD A MELODY GENERATOR

BUILD THIS:

25-WATT AUDIO AMPLIFIER MODULE



True 6 1/2 digit, high accuracy (0.003%) plus high speed sampling (333/s) – for $1690!*

The 7562, one of a line of desk-top multimeters, features Yokogawa's original feedback pulse width modulation method which gives excellent stability, high noise immunity and linearity.

- ***True 6 1/2 digit resolution without reduced dynamic range typical of some DMMs***
- ***6 1/2 digit accuracy ±0.003% +15dig (90days)***
- ***True rms ac ranges***
- ***GPIB and RS-232 interfaces***
- ***Large 1000 measurement memory capacity (up to 8000 using optional IC memory card)***
- ***Front and rear panel inputs***
- ***Extensive maths capability includes nulling, average, scaling, decibels and comparisons***

Check the 7550/7560 range

Model	7551	7552	7561	7562
Display digits	5 1/2		6 1/2	
Samples/second	125		333	
Vdc Accuracy	0.005%		0.003%	
Vac Accuracy	0.3%		-	0.15%
AC/DC Current	2A	20A	2A(dc)	2A
Ohms	200MΩ		200MΩ	
Frequency	–	•	–	–
Relative Measurements	•	•	•	•
Comparator	•	•	•	•
Data Hold	•	•	•	•
Range Hold	•	•	•	•
Memory	•	•	•	•
GPIB/RS-232	•	•	•	•

Call your nearest rep for comprehensive DMM brochure

New South Wales	Yokogawa	(02) 805 0699
Victoria	Yokogawa	(03) 819 1500
Queensland	L E Boughen	(07) 369 1277
S. Australia	T & M Instruments	(08) 269 1561
	Mayfield Electrical	(08) 238 5144
W. Australia	Leda Electronics	(09) 361 7821
Tasmania	Meacon Systems	(002) 44 7575
Auckland N. Z.	N E I	(AKL) 634 2732
Specialist Reps	Tech Fast	(02) 988 3865

YOKOGAWA

Yokogawa Australia Pty Ltd
A.C.N. 003 888 364
Centrecourt D3, 25-27 Paul Street North, North Ryde
Private Mail Bag 24 P.O. North Ryde N S W 2113

* *Price is plus sales tax and does not include any options illustrated*

SILICON CHIP

Vol.6, No.12; December 1993

FEATURES

4 Sound Blaster Grows Up *by Darren Yates*
16-bit CD-quality stereo sound card reviewed

8 Electronic Engine Management, Pt.3 *by Julian Edgar*
Changing the engine management software

40 The LM1875 Audio Amplifier IC *by Darren Yates*
Features in-built thermal & short circuit protection

53 Programming The 68HC705C8 Microcontroller *by Barry Rozema*
Lesson 3: answers to exercises & the direct addressing mode

90 Index To Volume 6, Jan–Dec. 1993
All the year's features & projects

PROJECTS TO BUILD

16 Remote Controller For Garage Doors *by Branco Justic*
It's easy to build & there are no alignment hassles

22 Build A Low-Voltage LED Stroboscope *by Darren Yates*
A digital readout shows the speed in RPM

32 A Low-Cost 25W Amplifier Module *by Darren Yates*
Compact module is based on a single IC

62 Peripherals For The Southern Cross Computer *by Peter Crowcroft*
An 8x8 LED matrix display & an EPROM emulator

80 Build A 1-Chip Melody Generator *by Bernie Gilchrist*
Choose from six different melodies or a medley of tunes

SPECIAL COLUMNS

42 Remote Control *by Bob Young*
Servicing your R/C transmitter

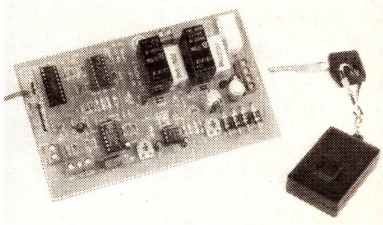
56 Serviceman's Log *by the TV Serviceman*
Whingeing Willie & the bouncing TV set

70 Vintage Radio *by John Hill*
My no-hassles radio museum

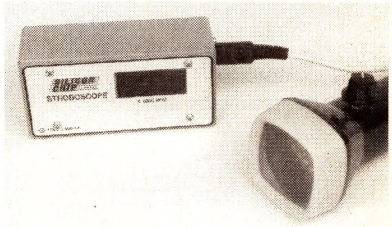
84 Amateur Radio *by Garry Cratt, VK2YBX*
A look at selective tone calling

DEPARTMENTS

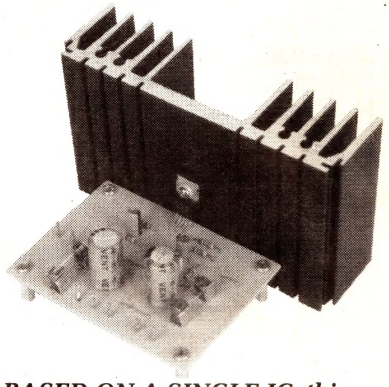
2 Publisher's Letter
36 Circuit Notebook
82 Back Issues
86 Order Form
87 Product Showcase
92 Ask Silicon Chip
95 Market Centre
96 Advertising Index



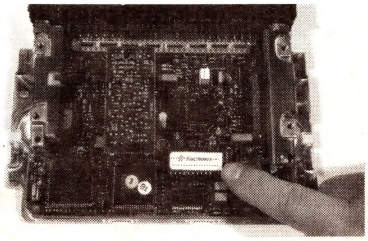
FIT YOUR GARAGE door with remote control by building this up-to-date circuit. It features a UHF keyring transmitter & a receiver that's built around a pre-aligned front-end module. Turn to page 16.



WANT TO MEASURE the speed of rotating machinery. This stroboscope uses high-intensity LEDs as its light source & gives a digital readout of the speed in RPM – see page 22.



BASED ON A SINGLE IC, this compact audio amplifier module can deliver 25W RMS into an 8Ω load & can be powered from single or dual supply rails. Construction starts on page 32.



ONE OF THE BEST ways of modifying an electronic engine management system is to change the software. This month, we take a look at the practicalities of chip re-writing – see page 8.

Publisher & Editor-in-Chief
Leo Simpson, B.Bus.

Editor
Greg Swain, B.Sc.(Hons.)

Technical Staff
John Clarke, B.E.(Elec.)
Robert Flynn
Darren Yates, B.Sc.

Reader Services
Ann Jenkinson
Sharon Macdonald

Marketing Manager
Sharon Lightner
Phone (02) 979 5644
Mobile phone (018) 28 5532

Regular Contributors
Brendan Akhurst
Garry Cratt, VK2YBX
Marque Crozman, VK2ZLZ
John Hill
Jim Lawler, MTETIA
Bryan Maher, M.E., B.Sc.
Philip Watson, MIREE, VK2ZPW
Jim Yalden, VK2YGY
Bob Young

Photography
Stuart Bryce

SILICON CHIP is published 12 times a year by Silicon Chip Publications Pty Ltd. A.C.N. 003 205 490. All material copyright ©. No part of this publication may be reproduced without the written consent of the publisher.

Printing: Macquarie Print, Dubbo, NSW.

Distribution: Network Distribution Company.

Subscription rates: $49 per year in Australia. For overseas rates, see the subscription page in this issue.

Editorial & advertising offices: Unit 1a/77-79 Bassett Street, Mona Vale, NSW 2103. Postal address: PO Box 139, Collaroy Beach, NSW 2097. Phone (02) 979 5644. Fax (02) 979 6503.

ISSN 1030-2662

PUBLISHER'S LETTER

The future of private motor vehicles

As I write this editorial, it is only a few days to the running of the 1993 World Solar Challenge race from Darwin to Adelaide. It remains to be seen whether the race sets records for speeds and race duration but is sure to be another step in the development of solar and electric vehicle technology. Ultimately though, the major spur for all this present research and development is the mandating of "zero emissions" vehicles for California in the very near future.

If it wasn't for the urgency created by the Californian legislators, no doubt there would be little development in this field at all. As it is, if a major car developer wins the Darwin to Adelaide race, they will be seen as the leaders in electric vehicle technology and will be poised to take the spoils in the Californian market.

This might lead you to think that if it wasn't for the artificial situation created in California there would be no reason to develop cars with lower or zero emissions. That would be a short-sighted view because air pollution continues to be a problem in large cities and our supplies of fossil fuels will continue to be depleted. So there needs to be a strong incentive for electric vehicles to be developed.

On the hand, I do not believe that some time in next century we will suddenly "run out of energy sources". It is true that fossil fuels will continue to be used up but I have enormous faith in the ability of man to solve any energy shortages. In fact, there is a word we use to describe that ability – "resourceful". Part of man's resourcefulness is his ability to extrapolate into the future and foresee problems before they become insurmountable.

So whatever happens, it is highly likely that we will still be driving our private motor vehicles well into the next century although they may not be petrol powered; they will probably be electric and they may well draw most of their energy directly from the sun. After all, solar powered planes have already flown, so why can't solar powered cars be a reality at some time in the future?

Leo Simpson

WARNING!

SILICON CHIP magazine regularly describes projects which employ a mains power supply or produce high voltage. All such projects should be considered dangerous or even lethal if not used safely. Readers are warned that high voltage wiring should be carried out according to the instructions in the articles. When working on these projects use extreme care to ensure that you do not accidentally come into contact with mains AC voltages or high voltage DC. If you are not confident about working with projects employing mains voltages or other high voltages, you are advised not to attempt work on them. Silicon Chip Publications Pty Ltd disclaims any liability for damages should anyone be killed or injured while working on a project or circuit described in any issue of SILICON CHIP magazine. Devices or circuits described in SILICON CHIP may be covered by patents. SILICON CHIP disclaims any liability for the infringement of such patents by the manufacturing or selling of any such equipment. SILICON CHIP also disclaims any liability for projects which are used in such a way as to infringe relevant government regulations and by-laws.

Advertisers are warned that they are responsible for the content of all advertisements and that they must conform to the Trade Practices Act 1974 or as subsequently amended and to any governmental regulations which are applicable.

LED BRAKE LIGHT INDICATOR

This "brilliant" brake light indicator employs 60 high intensity LEDs (550-1000mCd) to produce a display that is highly visible, even in bright sunlight. The intensity produced is equal to or better than the LED brake indicators which are now included in some late model "upmarket" vehicles. The LED displays used in most of these cars simply make all the LEDs turn on every time the brakes are applied. The circuit used in this unit can perform in this manner and, for non-automotive applications, it can be customised to produce a number of sweeps (1-10) starting at the centre of the display and with a variable sweep rate. It not only looks spectacular but also attracts more attention.

All the necessary "electronics" is assempled on two identical PCBs and the resulting overall length of the twin bargraph display is 460mm. It's simple to install into a car since only two connections are required: Earth and the brake-light connecting wire. The case for the prototype unit which would be suitable for mounting on the rear parcel shelf, was mainly made from two aluminium "L" brackets that were screwed together to make a "U" section. A metal rod and its matching holders (commonly available from hardware shops) are used for the supporting leg.

$60

for both the PCBs, all the onboard components & instructions: the 60 LEDs are included! We also have available a similar kit that does not have the sweeping feature. It produces similar results to the commercial units installed in cars: all the LEDs light up when power is applied.

$40

for both the PCBs and all the onboard components. This kit is also supplied with the 60 LEDs and it uses different PCBs, that have identical dimensions to the ones supplied in the above-mentioned kit.

LASER SCANNER ASSEMBLIES

These are complete laser scanners as used in laser printers. Include IR laser diode optics and a very useful polygon scanner (motor-mirror). Produces a "fan" of light (approx. 30 deg) in one plane from any laser beam. We provide information on polygon scanner only. Clearance:

$60

400 x 128 LCD DISPLAY MODULE – HITACHI

These are silver grey Hitachi LM215XB dot matrix displays. They are installed in an attractive housing and a connector is provided. Data for the display is provided. BRAND NEW units at a low:

$40

LASER OPTICS

The collimating lens set is used to improve the beam (focus) divergence. The 1/4-wave plate and the beam splitter are used in holography and experimentation. All are priced at a fraction of their real value:

1/4 wave plate (633nM) $20
Collimating lens sets $45
Polarizing cube beam splitters $65

GREEN LASER TUBES

We have a limited supply of some 0.5mW GREEN (560nm) HeNe laser tubes. Because of the relative response of the human eye, these appear as bright as about a 2mW red tube: Very bright. We will supply this tube and a suitable 12V laser power supply kit for a low:

$299

CCD ELEMENT

BRAND NEW high sensitivity monolythic single line 2048 element image sensors as used in fax machines, optical charachter recognition and other high resolution imaging applications: Fairchild CCD122. Have usable response in the visible and IR spectrum. Supplied with 21 pages of data and a typical application circuit.

$30

INFRARED TUBE AND SUPPLY

These are the key components needed for making an INFRARED NIGHT VIEWER. The tubes will convert infrared light into visible light on the phosphor screen. These are prefocussed tubes similar to type 6929. They do not require a focus voltage. Very small: 34mm diameter, 68mm long. All that is needed to make the tube operational is a low current EHT power supply, which we provide ready made or in kit form: powered by a 9V battery and typically draws 20mA. INCREDIBLE PRICING:

$90

For the image converter tube and an EHT power supply kit!

All that is needed to make a complete IR night viewer is a lens an eyeiece and a case: See EA May and Sept. 1990.

ALUMINIUM TORCHES – INFRARED LIGHTS

These are high quality heavy-duty black anodised aluminium torches that are powered by four "D" cells. Their focussing is adjustable from a spot to a flood. They are water resistant and shock proof. Powered by a krypton bulb – spare bulb included in cap.

$42

Note that we have available a very high quality INFRARED FILTER and a RUBBER lens cover that would convert this torch to a good source of IR: $15 extra for the pair.

PASSIVE NIGHT VIEWER BARGAIN

This kit is based on an BRAND NEW passive night vision scope, which is completely assembled and has an EHT coaxial cable connected. This assembly employs a high gain passive tube which is made in Russia. It has a very high luminous gain and the resultant viewer will produce useful pictures in sub-moonlight illumination. The viewer can also be assisted with infrared illumination in more difficult situations. It needs an EHT power supply to make it functional and we supply a suitable supply and its casing in kit form. This would probably represent the best value passive night viewer that we ever offered!

BECAUSE OF A SPECIAL PURCHASE OF THE RUSSIAN-MADE SCOPES, WE HAVE REDUCED THE PRICE OF THIS PREVIOUSLY ADVERTISED ITEM FROM $550 TO A RIDICULOUS:

$399

This combination will be soon published as a project in EA. NOTE THE REDUCED PRICE: LIMITED SUPPLY. Previous purchasers of the above kit please contact us.

24VDC TO MAINS VOLTAGE INVERTERS

In the form of UNINTERRUPTABLE POWER SUPPLIES (UPS's).These units contain a 300W, 24V DC to 240V 50Hz mains inverter. Can be used in solar power systems etc. or for their original intended purpose as UPS's. THESE ARE VERY COMPACT, HIGH QUALITY UPS's. They feature a 300W - 450W (50Hz) **SINEWAVE INVERTER.** The inverter is powered by two series 12V 6.5Ahr (24V). batteries that are built into the unit. **There is only one catch:** because these NEW units have been in storage for a while, we can not guarantee the two batteries for any period of time but we will guarantee that the batteries will perform in the UPS's when these are supplied. We will provide a 3-month warranty on the UPS's but not the batteries. A circuit will also be provided. **PRICED AT A FRACTION OF THEIR REAL VALUE: BE QUICK! LIMITED STOCK!**

$239

ATTENTION ALL MOTOROLA MICROPROCESSOR PROGRAMMERS

We have advanced information about two new STATE OF THE ART microprocessors to be released by Motorola: 68C705K1 and 68HC705J1. The chips are fully functional micros containing EPROM/OTPROM and RAM. Some of the features of these new LOW COST chips include:

***16 pin DIL for the 68HC705K1 chip * 20 pin DIL for the 68HC705J1 chip * 10 fully programmable bi-directional I/O lines * EPROM and RAM on chip * Fully static operation with over 4MHz operating speed.**

These two chips should become very popular. We have put together a SPECIAL PACKAGE that includes a number of components that enable "playing" with the abovementioned new chips, and also some of the older chips.

IN THIS PACKAGE YOU WILL GET:

* One very large (330 x 220mm) PCB for the Computer/Trainer published in EA Sept. 93; one 16x2 LCD character display to suit; and one adaptor PCB to suit the 68HC705C8.

* One small adaptor PCB that mates the programmer in EA Mar. 93 to the "J" chip, plus circuit.

* One standalone programmer PCB for programming the "K" chip plus the circuit and a special transformer to suit.

THE ABOVE PACKAGE IS ON SPECIAL AT A RIDICULOUS PRICE OF:

$99

Note that the four PCBs supplied are all silk screened and solder masked, and have plated through holes. Their value alone would be in excess of $200! A demonstration disc for the COMPUTER/TRAINER is available for $10. No additional software is currently available.

Previous purchasers of the COMPUTER/TRAINER PCB can get a special credit towards the purchase of the rest of the above package.

PLASMA BALL KIT

This kit will produce a fascinating colourful changing high voltage discharge in a standard domestic light bulb. The EHT circuit is powered from a 12V supply and draws a low 0.7A. We provide a solder masked and screened PCB, all the onboard components (flyback transformer included), and the instructions at a SPECIAL introductory price of:

$ 25

We do not supply the standard light bulb or any casing. The prototype supply was housed in a large coffee jar, with the lamp mounted on the lid – a very attractive low-cost housing! Diagrams included.

LASER DIODE KIT – 5mW/670nm

Our best visible laser diode kit ever! This one is supplied with a 5mW 670nm diode and the lens, already mounted in a small brass assembly, which has the three connecting wires attached. The lens used is the most efficient we have seen and its focus can be adjusted. We also provide a PCB and all on-board components for a driver kit that features Automatic Power Control (APC). Head has a diameter of 11mm and is 22mm long, APC driver PCB is 20 X 23mm, 4.5-12V operation at approx 80mA.

$85

PRECISION STEPPER MOTORS

This precision 4-wire Japanese stepper motor has 1.8 degree steps – that is 200 steps per revolution! 56mm diameter, 40mm high, drive shaft has a diameter of 6mm and is 20mm long, 7.2V 0.6A DC. We have a good but LIMITED supply of these brand new motors:

$20

HIGH INTENSITY LEDs

Narrow angle 5mm red LED's in a clear housing. Have a luminous power output of 550-1000mCd @ 20mA. That's about 1000 times brighter than normal red LED's. Similar in brightness SPECIAL REDUCED PRICE: 50c Ea or 10 for $4, or 100 for $30.

IR VIEWER "TANK SET"

ON SPECIAL is a set of components that can be used to make a **complete first generation infrared night viewer**. These matching lenses, tubes and eyepieces were removed from working tank viewers, and we also supply a suitable EHT power supply for the particular tube supplied. The power supply may be ready made or in kit form: basic instructions provided. The resultant viewer requires IR illumination.

$180

We can also supply the complete monocular "Tank Viewer" for the same price, or a binocular viewer for $280: Ring.

MINI EL-CHEAPO LASER

A very small kit inverter that employs a switchmode power supply: Very efficient! Will power a 1mW tube from a 12V battery whilst consuming about 600 mA! Excellent for high-brightness laser sights, laser pointers, etc. Comes with a compact 1mW laser tube with a maximum dimension of 25mm diameter and an overall length of 150mm. The power supply will have overall dimensions of 40 x 40 x 140mm, making for a very compact combination.

$69

For a used 1mW tube plus the kit inverter.

OATLEY ELECTRONICS

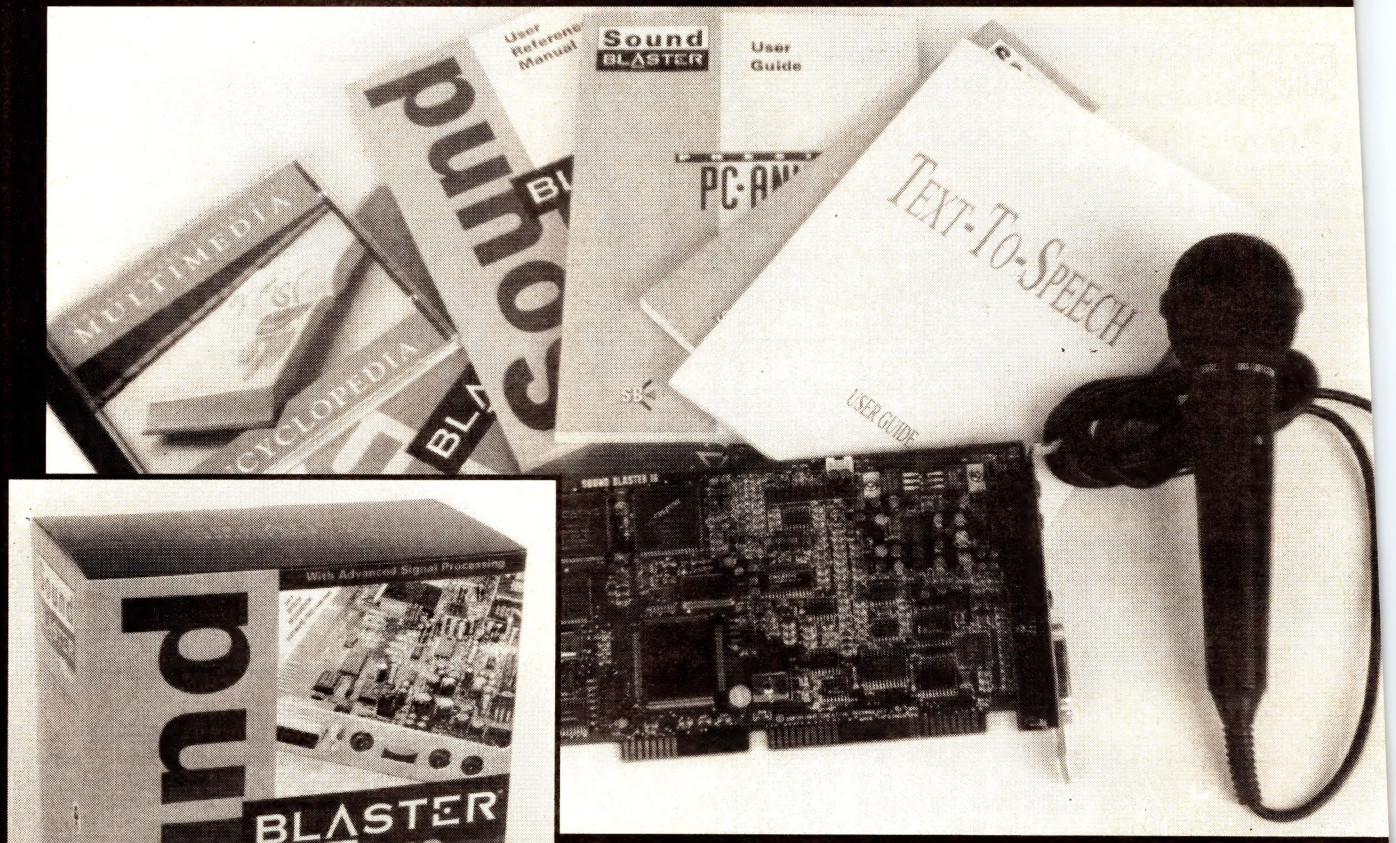
PO Box 89, Oatley, NSW 2223

Phone (02) 579 4985. Fax (02) 570 7910

MAJOR CARDS ACCEPTED WITH PHONE & FAX ORDERS

P & P FOR MOST MIXED ORDERS

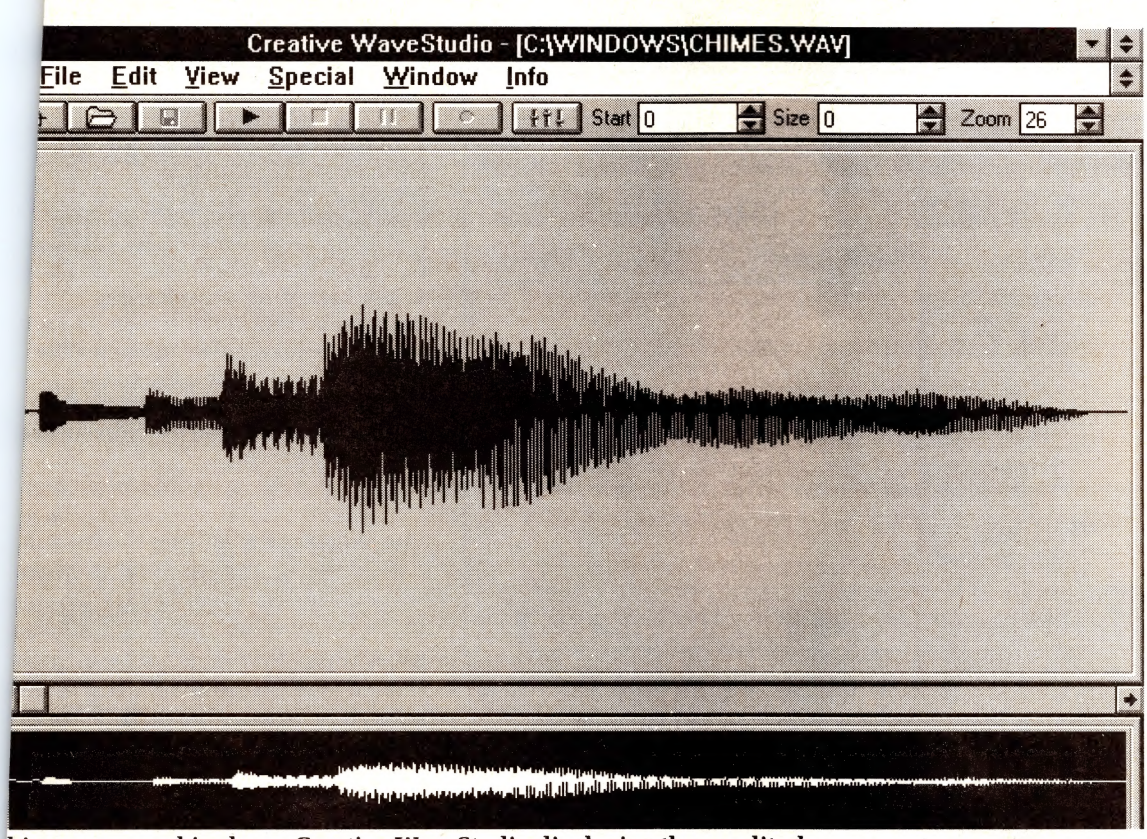
AUSTRALIA: $6; NZ (Air Mail): $10



Sound Blaster Grows Up!

The days of Sound Blaster cards being synonymous with games cards are numbered. The new Sound Blaster 16 ASP is a CD-quality 16-bit stereo sound card for use with audio sampling as well as multi-media presentations.

By DARREN YATES



his screen graphic shows Creative WaveStudio displaying the amplitude nvelope of the Windows sound file CHIMES.WAV. When the PLAY icon is elected, the sound file is played through with a marker indicating the current osition.

F YOU'VE BEEN around kids of late who have grown up with the PC ather than those silly little games nachines, they'll tell you that a game sn't a game unless you have a Sound Blaster card. And they're right too! Unless you have some pretty fancy software, the PC speaker doesn't lend itself to realistic sound reproduction and you can be surprised how much a sound card can add to the enjoyment of a game. (Not that we do that here, boss!)

However, the idea of sampling or recording audio input onto the PC is one which is likely to arouse the interest of many readers. The problem with the original Sound Blaster card was that it was only an 8-bit system. The quality of sound produced digitally is proportional to the number of bits used – in fact, the usual rule is 6dB of dynamic range for each bit. Thus, an 8-bit card would give you a range of 48dB, which is on a par with an standard cassette deck; ie, pretty poor.

Now that digital signal processing has become a viable reality, the people at Creative Labs Inc in the USA have finally come up with a 16-bit CD-quality sound card nicely wrapped with bundled software in a packag priced at only $399.

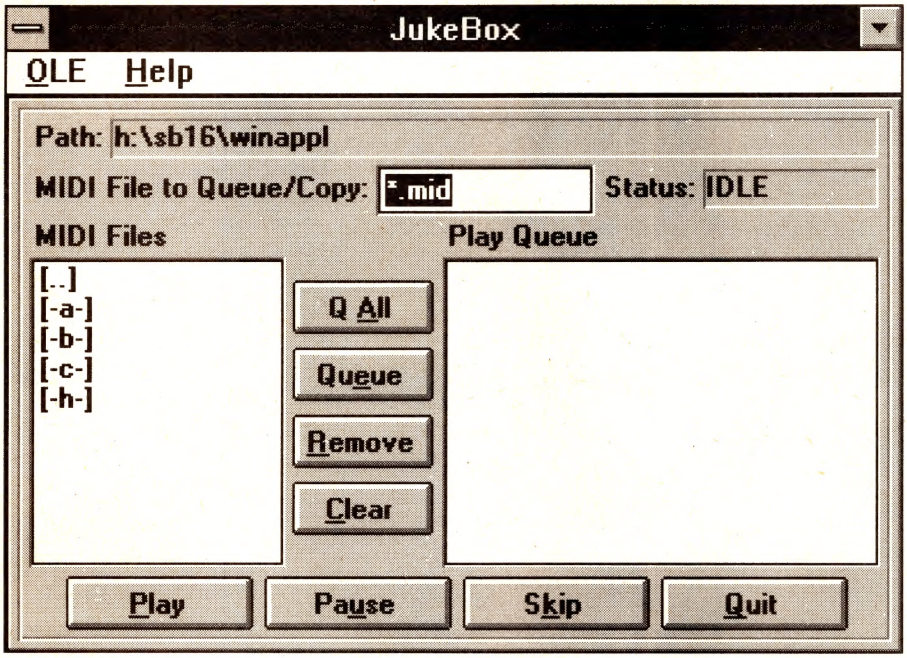
We recently obtained a copy of this latest addition to the Sound Blaster audio range from Dick Smith Electronics, who carry a wide range of the Sound Blaster products.

Opening the box

After clawing our way through the packaging, we were almost overcome with cards and books and discs and even a nicely-built microphone popped out. Seriously though, the 16-bit ASP system is jammed-packed with features which we'll outline in a moment.

The first thing we did was to install the card into one of our 386DX 40MHz machines and load in the first of the five discs that come with the package. Having looked through the directory of the disc, we found INSTALL.EXE and confidently marched forth.

All of the input & mixing levels are controlled by software through the Mixer control window. Individual controls for inputs include microphone, MIDI, CD & line levels. The bass & treble levels for each channel can be changed either together or separately using the mouse.



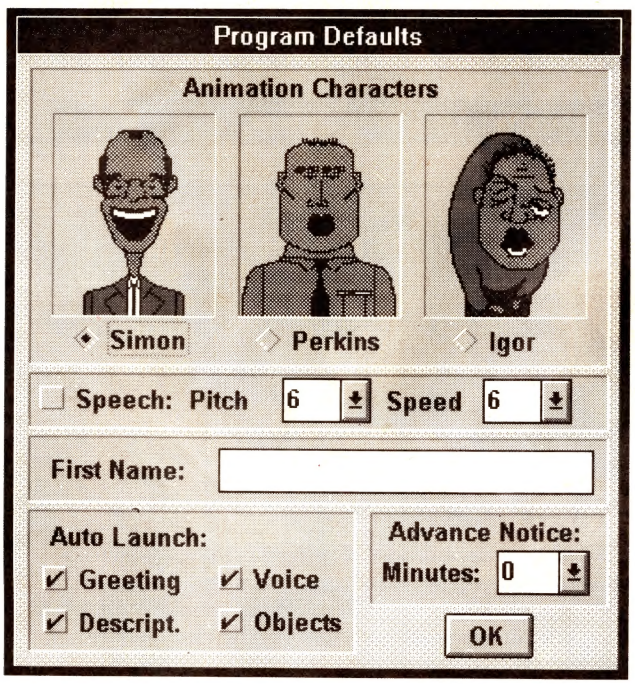
The JukeBox program allows you select any number of stored MIDI files & play them through the SoundBlaster voice generator chip. You can pause at any time, as well as skip any selection.

The installation program was simple to use and is automatic, just asking for the drive where the Sound Blaster files are to be stored (only because we were running two hard drives) and for the location of Windows. Now before those of you who dislike Windows dismiss the 16-ASP as a waste of time, the software also gives you the option of running either from the DOS prompt or Windows – pretty good, huh?

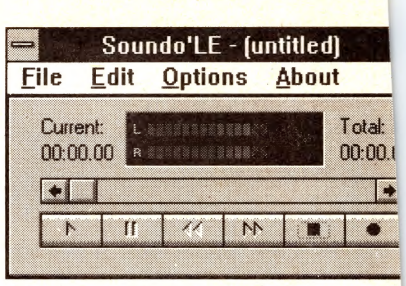
It also automatically checks and selects the I/O addresses for the internal card.

User manuals

Note that we haven't mentioned anything about user manuals at this stage. It's not because there aren't any – there are! It's just that whenever you get a new toy to play with, who reads the manuals beforehand? But having pushed our luck getting this far, common sense suggested that we were heading for a fall if we went any further without consulting the manual.



This is the main setup window for the Talking Scheduler program. This is a multimedia program which allows you to incorporate text-to-speech and voice annotation to your appointments. The speech & pitch controls allow you to change the tone of the artificially generated voice.



When recording a track using SoundO'le, this is the screen you wi see. The level display indicates the current signal level & the timer displays the current recording time well as the total time of the recorde file.

Because of the mountains of so ware included, there are six manua that explain it but amongst it all was nice, little, thin one entitled, in b letters, "Getting Started". It was onl about 30-odd pages – you little beauty

As it turned out, we had alread sailed through the first eight page and we were moving along comfort ably. The software installation is se up so that if you have an ordinary system with just a serial card, video card and printer card, there's nothing you have to do to the 16-ASP card before you install it.

If you have other cards in your machine, you may have to change some of the jumper settings on the ASP-16 card but the manual explains all of this so there's little chance of striking problems.

Sound Blaster Software

To explain all the features, it's easiest to go through the ASP-16 in terms of the software. The main Sound Blaster software comes on the first two discs, with the other three for the text-to-speech, PC Animate and Inter-Active multimedia software.

As already noted, Sound Blaster comes with DOS and Windows versions. The Windows version is the easiest to run (but is slower to get going), so we will go through this first (Windows 3.1 preferred).

When you boot up Windows, you'll find that it has created its own menu group and each program has its own icon. Now if you want to use it just to play games (what a waste!), we can tell you that there's nothing left to do. You can just load in your game and the installed driver which is automatically loaded when you boot up

take care of the rest – there's no d to get into Windows or type any- g else!

aving booted up in Windows, the thing you'll probably want to do y out the audio recording and see v good it is – and we can tell you it xcellent. The card employs a 16- 90dB CODEC (coder-decoder) chip ich is used in DAT recorders and ows sampling of CD-quality 16-bit nd at up to 44.1kHz. It also has o built-in audio amplifiers which n be set to either power external eakers or headphones.

The Windows Sound Blaster Icon oup includes six sections which are; aveStudio, SoundO'le, JukeBox, heduler, SB16 Mixer and Mosaic.

Both WaveStudio and SoundO'le low you to record audio signals but is SoundO'le which gives you the ost options. Double-clicking on the oundO'le icon brings up the record- g session mode but before you hit e record button, there are two things o check: the recording options and he mixer options.

There are a wide number of choices vailable for recording parameters. These include mono or stereo input, 8 r 16-bit sampling size and sampling ates of 11, 22 or 44.1kHz. You can also include echoes and reverb, as well as change the amplitude and speed of the recording.

However, its biggest advantage over a number of other software packages, including Microsoft's Sound for Windows which we reviewed several months ago, is that you can continuously record and dump the sound file straight to your hard disc. For example, say you have an empty 120Mb hard drive. This allows you 12 minutes of continuous stereo audio sampled at 44.1kHz/16-bits.

Multimedia applications

This ability to record direct to the hard disc makes it extremely useful in multimedia applications. Multimedia is the process whereby both sound and vision are used in a presentation for greater impact. Included with the bundled software is a copy of HSC Interactive, a Windows-based program which allows you to link sound files with bitmap images as well as animated vision.

The 113-page manual is a little long to go through here but nevertheless, it allows you to take control of your PC and create a presentation from the ground up. The program allows you to control when sound is played and allows for interactive usage via either keyboard or mouse.

Animation is created through a program called PC Animate Plus which allows you to draw and paint individual frames, then cut and paste these frames together. You can view these frames as you go and generate special effects such as smooth fades. And, of course, you can add in sound.

Test to speech translation

Finally, one of the more unusual programs which utilises the SoundBlaster card is the SBTALKER text-to-speech translator. Once you install the program, you can then use the simple read command and get the computer to actually say what ever is entered as an ASCII text file, or is typed in inside inverted commas.

Curiosity definitely got the better of me with this novel piece of software. I started off by just typing a few well chosen words and within a second or so, back they came! Next, I tried a text file – in fact, this very article – and again back it came. Although it is artificially generated speech using selected "mouth sounds" or phonemes, it was fairly easy to hear and understand.

In some cases though, words were spelt out rather than spoken and this probably occurs when a word is not part of a given vocabulary or SBTALKER doesn't know how to pronounce it. However, this is an area of computing which will take off in years to come when more efficient and faster algorithms can be written to make speech sound more lifelike than at present.

One thing worth noting is that this software has been patented which shows you that it's an idea that isn't quite as old as you may think.

Overall, the ASP-16 is the most advanced sound card I've seen so far for such a reasonable price and with 16-bit CD-quality sound, you can look forward to seeing and **hearing** some of the best games available.

The SoundBlaster ASP-16 sound system is available from Dick Smith Electronics and also from Rod Irving Electronics. **SC**

Silicon Supply and Manufacturing

PO Box 92 Bexley North NSW Australia 2207

74HC11	$0.45	74F00	.40	74F38	.65	74LS01	.50	74LS30	.40	74LS138	.60	74LS193	.80
74HC27	.40	74F02	.40	74F151	.55	74LS02	.50	74LS33	.50	74LS139	.60	74LS196	1.35
74HC30	.40	74F08	.40	74F163	.70	74LS03	.45	74LS49	2.35	74LS147	2.35	74LS240	.90
74HC76	.55	74F10	.40	74F169	1.92	74LS05	.45	74LS73	1.10	74LS148	1.05	74LS241	.95
74HC86	.45	74F11	.40	74F175	.65	74LS11	.50	74LS74	.45	74LS151	.50	74LS245	.80
74HC138	.85	74F20	.40	74F241	.95	74LS12	.50	74LS83	.75	74LS155	.50	74LS257	.60
74HC139	.50	74F21	.40	74F244	.90	74LS13	.85	74LS85	.60	74LS158	.70	74LS273	.80
74HC154	3.15	74F27	.40	74F257	.60	74LS14	.55	74LS90	.90	74LS160	.75	74LS366	.55
74HC165	.85	74F30	.40	74F258	1.80	74LS20	.55	74LS92	1.20	74LS164	.75	74LS368	.60
74HC174	.65	74F32	.40	74F353	1.45	74LS21	.40	74LS109	.90	74LS175	.80	74LS373	.80
74HC373	1.05	74F36	.85	74LS00	.50	74LS27	.40	74LS126	.50	74LS191	.80	74LS374	.85

MAIL ORDER SPECIALIST

Credit Cards welcome -Visa, Mastercard, Bankcard. Plus Sales Tax, packing and postage

Ph.: (02) 554 3114
Fax: (02) 554 9374

After hours only bulletin board on (02) 554 3114 (Ringback). Let the modem ring twice, hang-up, redial the BBS number, modem answers on second call.

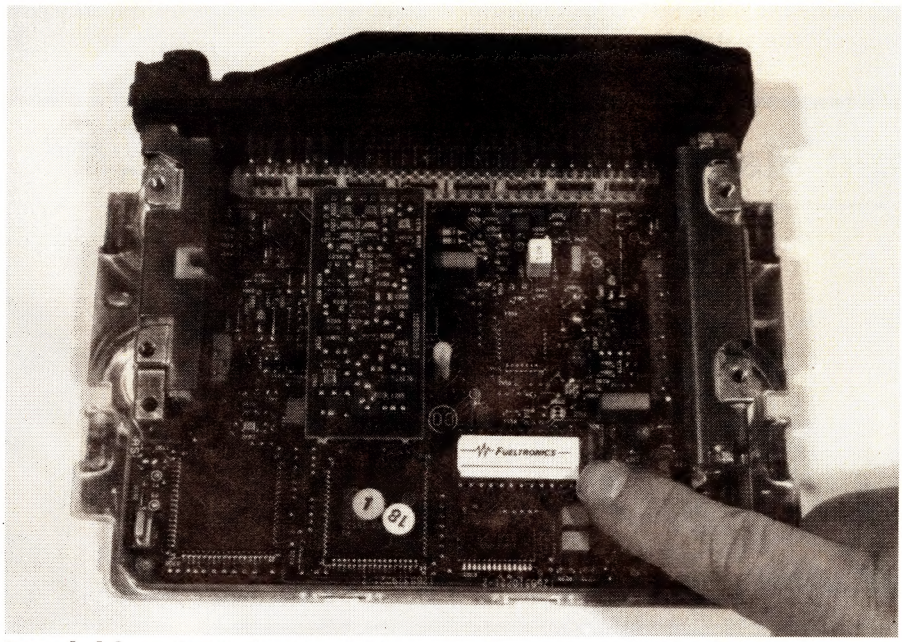
Electronic Engine Management

Pt.3: Chip Re-Writing – *by Julian Edgar*

One of the best ways of modifying an electronic engine management system is to change the software. If different fuel and ignition maps are programmed into the main memory chip, then different output data will be selected by the ECM in response to the various sensor inputs.

The beauty of modifying the ECM in this manner is that there are no physical changes made to the system. The original wiring harness, input sensors, injectors, ignition system and so on can be left unchanged. Also, the outputs from the ECM not directly related to engine performance – like transmission, air-conditioning and cooling fan control – can be left untouched.

One of the difficulties in chip rewriting is that the knowledge required to get into the software and make any changes is held by a select few. Secondly, major engine modifications may not be easily met by softwar changes alone.



Intended for a BMW, this Bosch Motronic electronic control module (ECM) features a reprogrammed main memory chip from Fueltronics.

Changing the chip

Chip rewriting is currently big busi ness, with basically two different ap proaches being taken. The first ap proach is to sell chips on the basi that a change of chip alone will yiel useful performance gains. This im plies that the original program wa not fully optimised in the first place otherwise how could useful gains be made in a chip produced in the aftermarket scene?

In naturally aspirated (non-turbo) cars, a chip-change alone will yield only a marginal power improvement – in the region of 5-10%. As a guide, a performance increase on the road from a chip-change might knock 0.2 seconds from a 0-100km/h time, dropping this time from perhaps 9.8 to 9.6 seconds. This performance gain generally comes from running a more aggressive (advanced) timing map, with steeper ramp angles. Extra fuel is injected to match the new timing (a factor that could lead to an increase in fuel consumption).

In turbocharged cars, the situation is a little different. With many cars running ECM-controlled turbo boost pressures, the chip-change might also include a lift in boost pressure. The greater gas flows which result from this will give a more substantial power

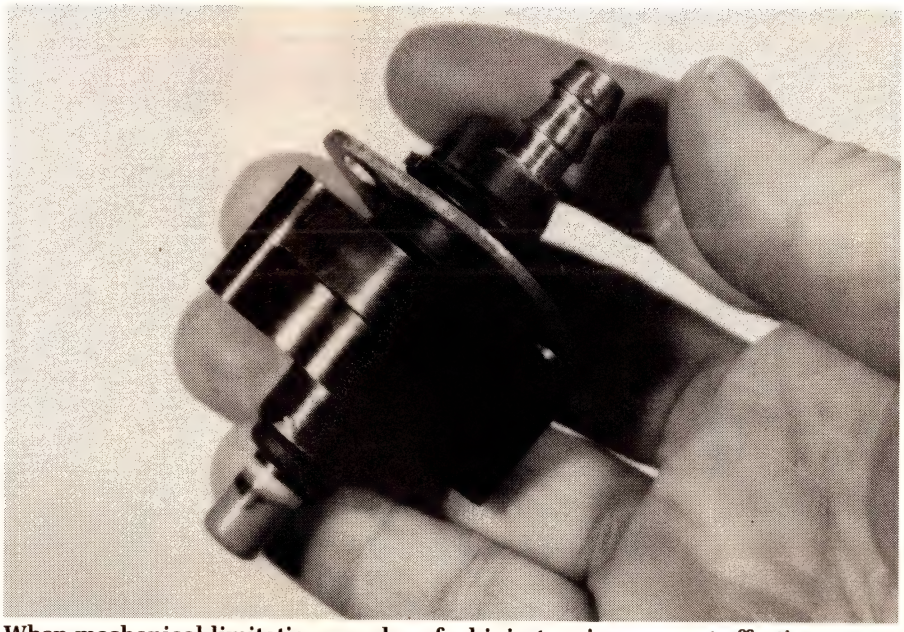
– often as much as 20% in round
res. The ignition and fuel maps
also changed to give the correct
tion timing and fuel mixtures to
with the increase in boost pres-
e.

both naturally inducted and turbo
, a lift in the rev limiter can also be
luded in the new software. The rev
iter built into the engine manage-
nt systems of cars is designed to
vent over-revving, which is poten-
ly very damaging to the engine.
th the pistons having to be acceler-
d to full speed, stopped, and then
celerated again in the opposite di-
ction every time the crankshaft
ns, the strain on engine parts such
the con-rods is very great.

Increasing the engine revs dramati-
lly increases the loads placed on
gine components, bringing them
oser to the point of failure. Too high
RPM will cause breakage, with per-
aps the piston exiting the side of the
ock or trying to come through the
ead!

However, an engine which is still
eveloping usable torque high in the
ev range will yield more power if the
ngine can rev higher. This is because
f the equation: Power (kW) = Torque
Nm) x RPM/9550.

In some engines, the manufacturer
as been conservative in the rev limit
mposed, mostly to improve engine
ongevity. If a potentially shorter work-
ng life is tolerable, then the rev limit
an be raised with a power improve-



When mechanical limitations, such as fuel injector size, prevent effective software changes, higher capacity components need to be fitted to the engine. The results can be worthwhile, as illustrated in Fig.3.

ment. Increasing the rev limit is an engine-to-engine proposition, though.

Other engine modifications

Much greater power (and potentially economy) gains can be gained if major engine modifications are performed and the ECM software then changed to suit. In other words – as has always been the case – airflow into and out of the engine can be improved, thus giving potentially more power when mixed with the appropriate amounts of fuel.

All of the traditional "hotting-up" methods can be used: free-flow exhausts and mufflers, better air filters, bigger valves, porting the head, different camshafts and so on. Once these mechanical changes have been made, the car can then be "driven" on a chassis dynamometer, with exhaust gas analysis being used to constantly monitor the mixture under different loads.

The areas then requiring modification can be ascertained and the ECM software appropriately rewritten. The

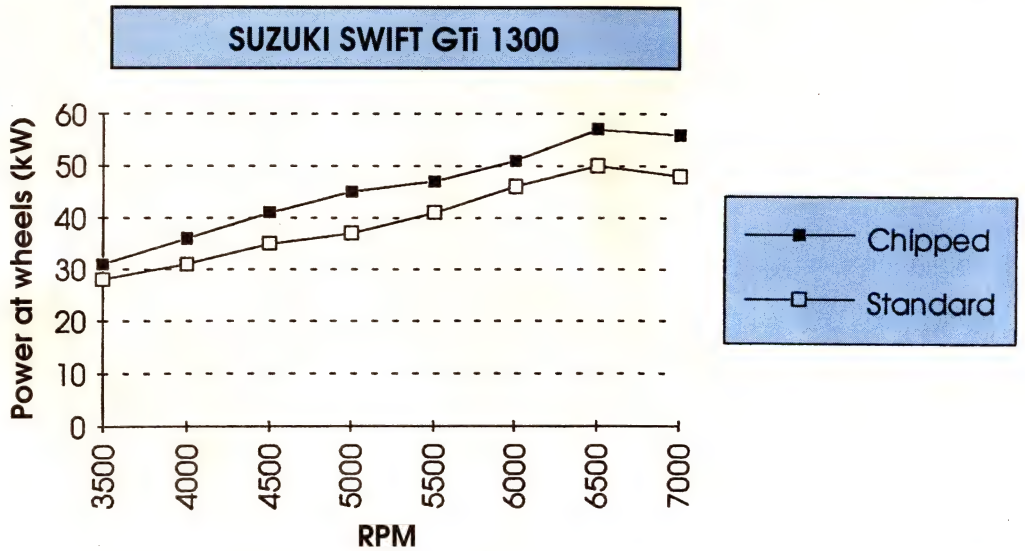


Fig.1: this chassis dynamometer graph shows the effect of replacing the ECM chip in a Suzuki Swift GTi 1300 fitted with a DOHC 16-valve engine. No other engine modifications were made.

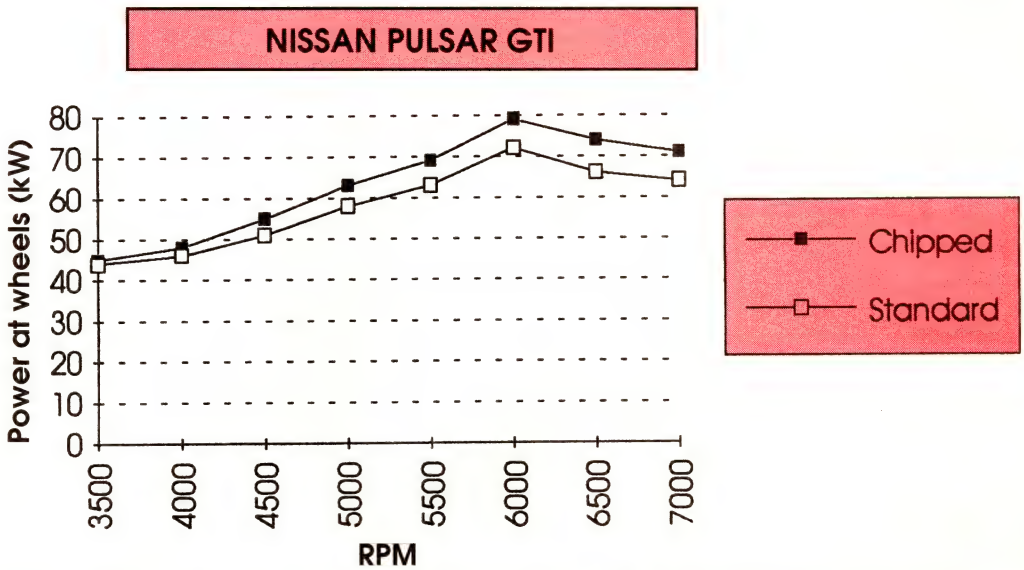


Fig.2: the effect of chip replacement in a Nissan Pulsar GTi 1800 (DOHC 16-valve engine), fitted with a free-flow exhaust system.

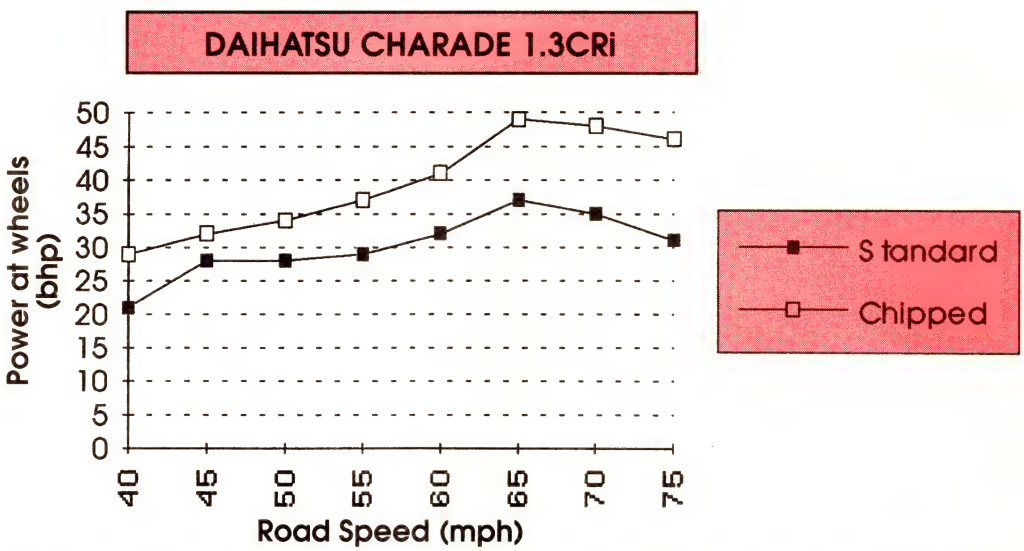


Fig.3: the effect of chip replacement in a 1992 Daihatsu Charade CRi 1300, fitted with larger fuel injectors.

car should then be rechecked in its final form. If done with appropriate expertise, the car should also remain quite legal in terms of its emissions.

Sometimes, however, a hardware change will be needed in addition to the software modifications. This could come about, for example, when the engine power has been greatly increased. The original fuel injectors may simply not be able to pass enough fuel, even if held open for long duty cycles.

In this case, the original injectors would then be replaced with larger units and the software reprogrammed to provide shorter pulse widths at all but the highest load situations. With an all-out race engine, the standard ECM may not be adequate and would then be replaced with a fully programmable computer.

Chip switches

Another approach is to use more than one new software program, with the change over between different programs being effected by a dash-mounted switch. For example, in a turbocharged car, one switch position could give a high boost and rich top-end mixture for maximum power, while another switch position could be for the standard software program. Yet another position could be for low-boost, lean-mixture economy running, while the final switch position could have a blank program. The blank program would be in place as a security measure, to make it more difficult to steal the car!

Other alternative switch position

ower & torque outputs should be measured on a chassis ynamometer to assess the results of any software or ardware changes. Changing the ECM chip alone will ead to only a marginal improvement in a naturally spirated car.

rograms can include a "valet" (or son and daughter) node, where the rev limiter is reduced to perhaps 4000RPM. Some manufacturers (notably in the United States) have fitted valet switches as standard to their powerful V8-engined sports cars.

Rewriting original-equipment car ECM memory chips requires appropriate computer programming expertise, good mechanical understanding, and access to sophisticated equipment such as exhaust gas analysers and chassis dynamometers. The car manufacturers also make it very difficult to gain entry to their software, with encryption codes and other security measures employed. "Breaking in" can take months.

There are a few companies in Australia that are modifying car ECM software for specific applications, and a much greater number selling general "hot-up" chips. Many of these chips originate overseas and are being sold by retail outlets with little understanding as to what has actually been done to the program.

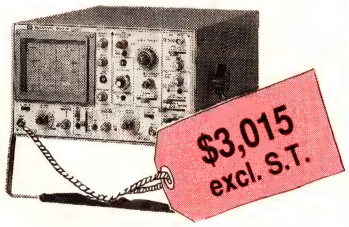
Chips that aren't so hot

There have also been some interesting tales circulated of "hot" chips which actually retard timing and fuel compared to the standard chip, until the last few hundred RPM where they revert to the original manufacturer's specifications. The cars drive poorly until the end of the rev range, at which point they appear to go like hell! If you choose to swap the ECM chip alone, then carry out performance and/or chassis dynamometer tests before and after chip fitment – and try to get a money-back guarantee. **SC**

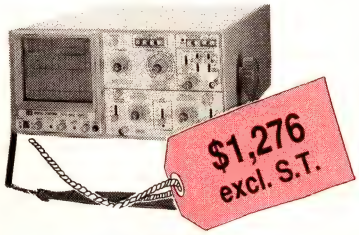
Acknowledgement: thanks to Fueltronics (16 Payneham Rd, Stepney, SA 5069 – phone 08 363 2199) for providing some of the information used in this article.

GW QUALITY SCOPES

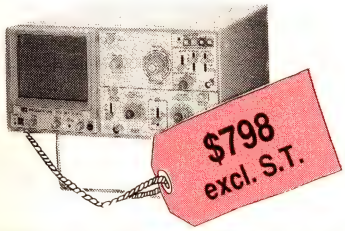
100MHz



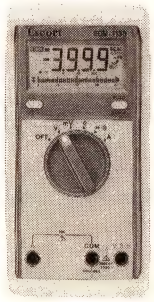
40MHz



20MHz



PLUS FREE DMM



ESCORT EDM-1133

- 3¾ Digits
- Autoranging
- 8 Functions
- DC V, AC V
- DC A, AC A
- Ohms

Valued at **$127!**

GOS-6100	GOS643	GOS622
4 Channels	2 Channels	2 Channels
100MHz BW	40MHz BW	20MHz BW
500uV - 5V/DIV	1mV - 5V/DIV	1mV - 5V/DIV
Dual Timebase, to 2ns/DIV	Dual Timebase, to 2ns/DIV	Timebase to 2ns/DIV
Dual Timebase Trig.	Auto Trigger Level Lock	Auto Trigger Level Lock
Variable Hold-Off	Variable Hold-Off	Variable Hold-Off
20kV Accel. Voltage	12kV Accel. Voltage	2.2kV Accel. Voltage

EMONA INSTRUMENTS

NSW (02) 519 3933
VIC (03) 889 0427
QLD (07) 397 7427

Also available from:

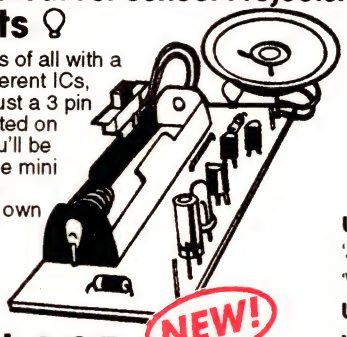
WA (09) 244 2777 SA (08) 362 7548 TAS (003) 31 6533

DICK SMITH ELECTRONICS

YOU CAN BUILD ANYTHING

Make Your Own Doorbell Or Great For School Projects!

Melody Generator Kits



Create the most unique doorbell or projects of all with a sound generator kit. With a choice of 6 different ICs, you can produce a 64 note melody using just a 3 pin IC, a PCB and a few external parts. Operated on just a single 1.5V battery (not supplied) you'll be astounded by the sound generated from the mini speaker. You'll also find the kit great when inserted into toys or designed around your own projects. Each kit comes complete with a melody IC, battery holder, PCB and all external components.

Christmas Melody	Cat K-5502
Home Sweet Home	Cat K-5504
Wedding March	Cat K-5506
Fur Elise	Cat K-5508
The Waltz	Cat K-5510
Mary Had A Little Lamb	Cat K-5512

NEW!

$9.95 ea

Silicon Chip Dec'93

Melody Sound Generators

If you ever want to change the tune of your melody kit, simply replace the current IC with one of these alternative low-cost ICs.

NEW!

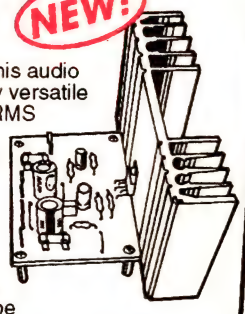
UM 66T01	'Jingle Bells', 'Santa Claus Is Coming to town' and 'We Wish You a Merry Christmas'	Cat Z-6210	**$2.95**
UM 66T05	'Home Sweet Home'	Cat Z-6212	**$2.95**
UM 66T09	'The Wedding March'	Cat Z-6214	**$2.95**
UM 66T19	Beethovens' 'Fur Elise'	Cat Z-6217	**$2.95**
UM 6632	Mozarts' 'The Waltz'	Cat Z-6218	**$2.95**
UM 66T33	'Mary Had A Little Lamb'	Cat Z-6219	**$2.95**

*Data sheets available at all stores.

Low-Cost And Easy To Build!

25 Watt Amp Module

NEW!



You'll save both time and money assembling this audio power module! It's a very simple, yet extremely versatile circuit based on a single IC. It produces 25W RMS into 8 ohms and 20W RMS into 4 ohms and, with a signal-to-noise (S/N) ratio of 110dB and a distortion figure of just 0.025% for 1kHz at 20W and using a pair of modules, it'd be an ideal basis for a hi-fi stereo amplifier. The unit also offers internal short-circuit protection, in-built thermal protection and current limiting to 4A to prevent damage when driving reactive loads, making it very reliable. The module will be supplied in short form with all components, PCB and heatsink.

Cat K-5602

Silicon Chip Dec '93

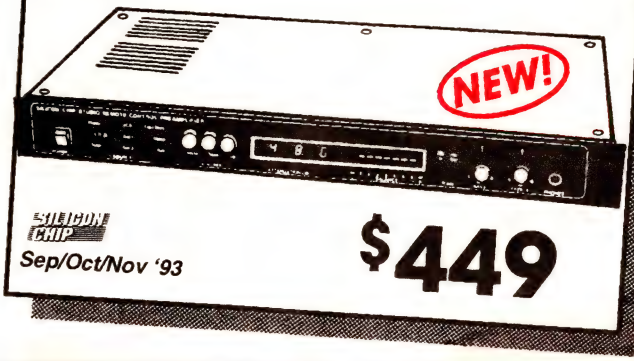
$29.95

The Latest In Audio Design Technology!

Stereo Pre-Amplifier With Infrared Remote Control

After you build this kit you can really sit back and enjoy the finished product. You won't have to leave your chair once you have the remote control in your hand! Use it to adjust volume and balance or to select the program from 6 signal sources (phono, CD, Tuner, VCR, Aux 1 and Aux 2 and tape deck). This convenient remote solves the limitations of conventional models. Because there are no moving parts in the volume control, there's no noise distortion when you alter the volume, additionally, the channel tracking emits no noise even at the lowest volume level. The front panel of the amplifier features green LEDs to indicate settings made via the remote control as well as the selected program source. Comes with all components, hardware, PCB's, deluxe pre-punched case, pre-punched screened front panel and a deluxe remote control case and front panel to suit.

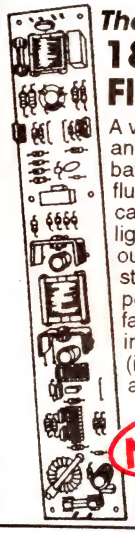
Cat K-5550



NEW!

Silicon Chip Sep/Oct/Nov '93

$449



The Most Efficient Light Of All!

18/36 Watt Fluorescent Inverter

A very efficient source of light, this inverter powers either an 18W or 36W slimline fluorescent tube from a 12 volt battery. This inverter is a marked improvement on other fluorescent inverters, making it perfect for camping, caravans, emergency light or as part of a solar powered lighting installation for remote areas. It offers a light output equal to conventional mains powered lamps, fast start (without flicker), pre-heated filaments, reverse polarity fuse protection as well as fuse protection for faulty tubes and low electromagnetic radiation. Comes in shortform, complete with all components, hardware (including heatsinks), PCB and transformers (ie cores and formers). Cat K-3004

NEW!

Silicon Chip Dec '93

$69.95

Please contact your nearest store for availability as some kits may still be in production.

CHOOSE FROM OUR EVER-GROWING LIBRARY!

Corel Draw Visual Quickstart Guide 4

Teach yourself how to work with Corel Draw the quick and easy way! This is the latest edition of the concise publication that has been very popular in the past. Using pictures rather than lengthy explanations make it much easier to follow and its reference structure means that it's very quick to use - simply look up what you need and continue with your work!

Cat B-6351

$34.95

ARRL Radio Handbook, 1993

All the latest information for the avid amateur radio operator with even more articles, many more new projects to build and a wealth of information.

Cat B-2226

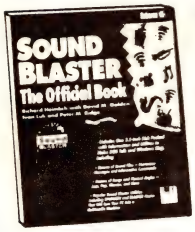
$39.95

Morphing Magic

Discover how the sensational visual effects used in movies like Terminator 2 were created! This fascinating book introduces you to the magical world of morphing and shows you how to do it yourself. It's easy-to-understand and includes a companion disk that lets you create stunning special effects on your computer. Anyone can do it!

Cat B-6722

$49.95

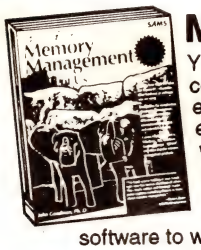


Sound Blaster - The Official Book

The one and only book endorsed by Sound Blaster's manufacturers Creative Labs, it covers the whole family of Sound Blaster cards including Sound Blaster Pro, the new Sound Blaster 16 and the Soundblaster Multimedia Kit. Comes complete with a 3.5" disk packed with information and utilities.

Cat B-6710

$59.95



Memory Management

You'll get the most out of your PC after you grasp the complexities of memory management! Apart from explaining the difference between conventional, expanded and extended memory and providing you with an understanding of basic concepts and principals of memory management, this book gives sound advice on how to maximise your PCs' speed and efficiency by getting your hardware and software to work together in the most productive way.

Cat B-6196

$69.95

Artificial Life Explorer's Kit

A fun-filled beginner/intermediate introduction to the new science of 'Artificial life'. Includes a complete glossary of new terminology - even words that are just coming into use and a 3.5" disk of nine compressed, self-expanding DOS and Windows based programs that allow the reader to create, manipulate and meddle with artificial life forms.

Cat B-6720

$39.95

Boatowners Guide To Marine Electronics

The latest edition of the essential reference guide for all boat owners makes life much easier! It provides all the information you need about marine electronics such as radios, fishfinders and radar, making it very easy to determine what gear you need, where to get it and how it works. Plus, you'll find the installation, maintenance and troubleshooting very helpful.

Cat B-4505

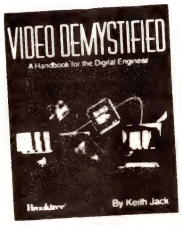
$42.95

Boatowner's Illustrated Handbook Of Wiring

You'll be able to keep your boat in ship-shape condition once you read this user-friendly guide to customising your boat's AC and DC systems! Written specifically for onboard electrical projects, it covers a range of topics from fixing loose connections to rewiring your boat. Illustrations make it simple to follow.

Cat B-4500

$59.95

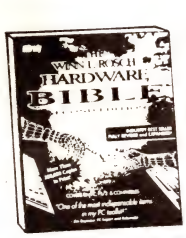


Video Demystified

This comprehensive volume will delight digital and software engineers and anyone who wants to explore the relationship between video and computer graphics. It provides a thorough examination of the essentials of today's video standards as well as contemporary applications. With the aid of its diagrams, tables and illustrations, you'll find it easy to understand.

Cat B-6120

$59.95



Hardware Bible - 2nd Edition

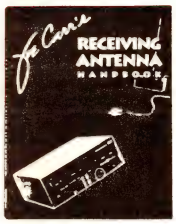
A thorough examination of microcomputers for readers who seek more knowledge about IBM PCs and compatibles. Newly revised and greatly expanded, it contains all the answers to everything you've ever wanted to know about PCs.

Cat B-6198

$69.95

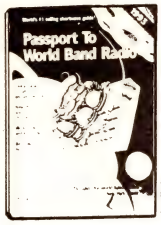
RADIO GEAR FOR ALL ENTHUSIASTS!

Receiving Antenna Handbook' For DXL & SWL



A comprehensive and thorough guide to high performance receiving antennas from longwave through to shortwave. It covers everything you need to know on this topic such as; the basic theory behind all receiving antennas, special designs for indoor and limited space applications and getting a good ground connection at radio frequencies. Plus, it includes complete easy-to-follow instruction details for each antenna.
Cat B-2045

$39.95



Save $10

'Passport To World Band Radio'

Essential reading for anyone who's getting started with a shortwave receiver. It's the 1993 edition and it includes all the changes that have taken place in Europe and Russia. Provides you with all you want to know about what's on shortwave radio, the best and worst radios, how to get the most from your shortwave listening and more!
Cat B-2052

$19.95

Save $8

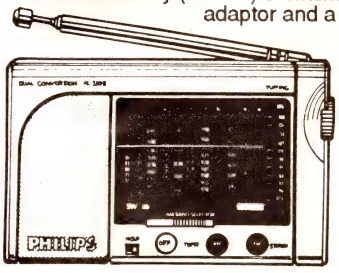
'World Radio TV Handbook 1993'

The ultimate directory of international radio and television. Gives complete listings including frequencies, addresses, call signs, station identification and transmission times. There's even a special feature on how to convert local time against UTC.
Cat B-2093

$24.95

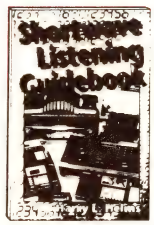
Dual-Conversion AE 3405 Receiver

Tune into this Pocket-sized 12-band dual conversion receiver that offers both AM and FM reception as well as 9 international SW bands. It features DBB switch for enhanced bass, and a tuning LED indicator for easy operation. A hold function prevents the current station from being accidentally interrupted by making all the other buttons inoperative, and there's both a telescopic aerial for shortwave and an inbuilt aerial for AM and LW reception. It can be either battery (2 x AA) or mains operated with an optional AC adaptor and a stereo headphone socket is supplied for personal listening. Comes complete with protective carry case and shortwave hand-book.
Cat D-2856



$99.95

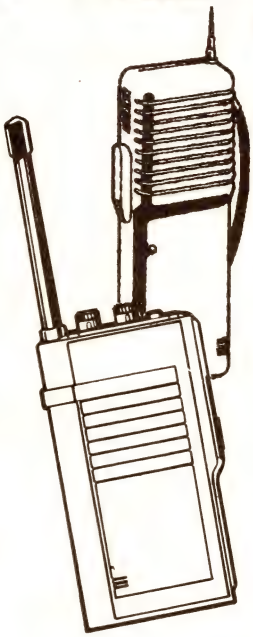
PHILIPS



'Shortwave Listening Guide', 1993

The whole world's talking on shortwave radio and this book tells you how to listen in! It contains everything you need to know about shortwave; selecting the right shortwave radio, how reception conditions vary, how to operate shortwave radio correctly, profiles of international stations and more!

Save $10! Cat B-2040 **$19.95**



Quality FM Walkie Talkies

Very high quality walkie talkies with a long range - up to 200m. Ideal for the kids, they operate on the 27MHz band and use FM transmission for great audio quality. No license is required and they come complete with a telescopic antenna and carry strap. 9V battery required per unit. Cat D-1090

digitor **$69.95 / pa**

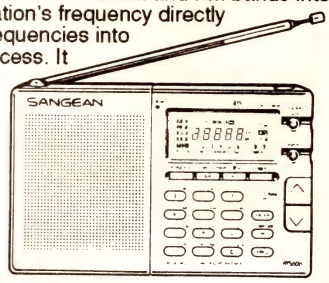
Hands-Free 55 MHz Transceiver

With a range of up to 500m outdoors and no license required, this hand-held FM transceiver also comes complete with belt-clip and an ear-piece/tieclasp microphone for hands-free use. Has selectable push-to-talk or voice activation, plus a sensitive dual-conversion receiver. Requires 9V battery. Cat D-1095

$69.95 ea **digitor**

Compact 45-Memory Shortwave Receiver

The super compact ATS-606 makes finding your favourite shortwave (and local) stations as easy as pushing a button. Let it scan through the bands for you or, with the new Auto Tuning system, it will locate and put the nine strongest signals on both the AM and FM bands into memory. You can also key in a station's frequency directly from the keypad or put up to 45 frequencies into memory for instant push-button access. It gives continuous shortwave coverage from 1.715-29.995MHz, and 13 international SW band divisions can be directly accessed. Comes with stereo earphones for FM stereo operation and has an antenna socket for connection of an external antenna.



Cat D-2847

$269

SANGEAN

MAJOR DICK SMITH ELECTRONICS AUTHORISED STOCKISTS
NSW ARMIDALE: New England Electronics 71 1655 **BALLINA:** Ballina Electronics 86 7022 **BATEMAN'S BAY:** Baycity Sight & Sound 72 5030 **BATHURST:** Electronic Frontiers 32 3933 **BOURKE:** Countrywide Services 72 2150 **BOWRAL:** Bowral Electrical Suppliers 61 1861 **BROKEN HILL:** Hobbies & Electronics 88 1498 **COOTAMUNDRA:** Cootamundra Music & Light 422561 **COFFS HARBOUR:** Coffs Harbour Electronics 525 684 **DENILIQUIN:** Deni Electronics 813672 **DUBBO:** Chris's Hi Fi 828711 **GOULBURN:** Tunlive 221288 **GRAFTON:** Repairs & Spares 421911 **GRIFFITH:** Miatronics 624534 **INVERELL:** Inverell Electronics 221821 **KATOOMBA:** Niagara Photo & Sports 822800 **KEMPSEY:** P & K Richards 631134 **LEETON:** Leeton Audiotronic 532800 **LIGHTNING RIDGE:** Lightning Ridge Solar Power 291013 **LISMORE:** Decro Electronic Services 214137 **LITHGOW:** Douroy Photographics 513173 **MACKSVILLE:** Macksville Electronics 682 899 **MOREE:** Moree Electronics 522091 **MUDGEE:** Headwear 723895 **MURWILLUMBAH:** Strings & Things 723 684 **NARRABRI:** Namoi Computer Service 923274 **NELSON BAY:** Nelson Bay Elect. & Hobbies 813685 **NOWRA:** Nowra Electronics 210722 **PARKES:** Strad Music Centre 623366 **RICHMOND:** Silicon Crafts 784101 **TAREE:** Manning Electronics 512233 **TUNCURRY:** Tuncurry Electronics 545006 **ULLADULLA:** Coastal Electronics 553989 **WAGGA WAGGA:** Phillips Electronics 216538 **WALGETT:** Walgett Electronic Centre 281111 **WINDSOR:** Hawkesbury Electronics 776722 **YASS:** Warmington Electrical 261411 **YOUNG:** Keith Donges 821279 **VIC ARARAT:** Jerram Electronics 522345 **BAIRNSDALE:** Green Gage Services 525677 **BENALA:** North East Electronics 622710 **CASTLEMAINE:** Inspect Electrics 723773 **COLAC:** Colac Electronics 312847 **ECHUCA:** Gilmour Electronics 822956 **MILDURA:** Pullman Auto Pro 232882 **MORWELL:** Roylaine Pty Ltd 339458 **ROSEBUD:** Seatech Vic Pty Ltd 822225 **SHEPPARTON:** Andrew Guyatt Electronics 219497 **SWAN HILL:** Nyah District TV Service 329303 **ST. ARNAUD:** Whartons Appliances 951069 **WARRAGUL:** Roylaine 234255 **WARRNAMBOOL:** Koroit St. Elect. Services 627417 **WONTHAGGI:** South Gippsland Photo Service 721411 **QLD AYR:** Delta Electrix 831566 **BLACKWATER:** Cool Tronics 825827 **BOWEN:** Plaza Electronics 863477 **BUNDABERG:** Bob Elkin Electronics 521785 **CALOUNDRA:** Electro-mart 918533 **DALBY:** Hobby & Electronics 625770 **EMERALD:** Cooltronics 825222 **GLADSTONE:** Electronic Enterprises 726660 **GOONDIWINDI:** CTW Electronics 713411 **INGHAM:** Masons Electronics 763188 **INNISFAIL:** Innisfail Hi-Fi 612014 **KINGAROY:** MD & MM Siegle 624535 **MACKAY:** Steven's Electronics 511723 **MARYBOROUGH:** Keller Electronics 214559 **MOSSMAN:** Mossman Electronics 982200 **MT. ISA:** Outback Electronics 433331 **NAMBOUR:** Nambour Electronics 411966 **PIALBA:** Keller Electronics 283749 **STANTHORPE:** Granite Belt Communications 813333 **TAS BURNIE:** Electronic City 314 760 **DEVONPORT:** Al Electronics 248322 **SA MT. GAMBIER:** Hutchesson's Communication 250400 **PORT LINCOLN:** Basshams TV & Comp. World 830075 **WHYALLA:** Eyre Electronics454764 **WA ALBANY:** Micro Electronics 412077 **BUNBURY:** Micro Electronics 216222 **COWARAMUP:** CPA Electronics 555448 **GERALDTON:** Angora Lighting 211278 **MANDURAH:** Mandurah Hi Fi 5812206 **MARGARET RIVER:** CPA Electronics 573888 **PORT HEDLAND:** Ivan Tomek Electronics 732531

SAVE MONEY - GET YOUR POWER FROM THE SUN!

Solar Modules And Chargers For Low Power Applications

Solar Modules

Can be used individually or interconnected for increased voltage (series) or current (parallel).

0.45V 400mA

Cat O-2000

$3.50

0.45V 1A

Cat O-2001

$6.95

Solar NiCad Chargers

Sit one on your window sill and let the sun power up your Nicad rechargeable cells for free!

2 x AA

Cat O-2002

$7.95

4 x AA

Cat O-2003

$14.95

Solar panel And Charger - 3/6/9V

Comes with multi-adaptor two meter cord, alligator clips, 2.5mm, 2.1mm & 1.3mm female plugs, 3.5mm, 2.5mm male plugs. Supplies 3V or 4V at 100mA, 6V or 9V at 50mA.

Cat O-2004

$24.95

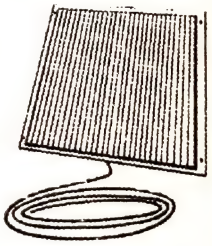
Solarex SA-5 Amorphous Silicon Module

Designed for use with a 12 volt battery. Ideal for maintaining the charge on marine and vehicle batteries, powering 12V DC devices and more.

Size: 306 x 346 x 21mm
Peak Watts: 5 watts
Current @ nom. voltage: 0.33A
Volts (open circuit): 23V
Cat O-1005

$127

5 Year Limited Warranty



HANDY TOOLS FOR THE WORKSHOP!

'Hotrod' Soldering Irons

Exceptional Value For Money! Make soldering easy with one of these extremely efficient soldering irons. They have 240V operation, 370°C operating temperature, long-life replaceable tips and lightweight handles.

25 watt

Cat T-2300

Only $19.95

40 watt **Now Available**

Cat T-2305

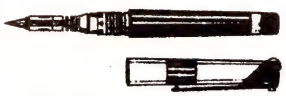
Only $24.95

Nimrod Soldering Iron

Four Tools In One!
A butane powered iron that can also be turned into a handy blowtorch, hot knife and hot air gun.*
(Gas not included)

Cat T-1385

NIMROD



*With The Use Of Optional Tips.

Compact Soldering Kit

A quality, yet very reasonably priced butane powered soldering tool. It comes in a compact kit complete with 4 tips, stand and cleaning sponge. Additionally, it includes a pair of cutters, a pair of pliers and a roll of resin-core solder. (Gas not included).

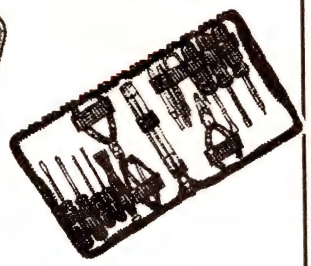
Cat T-1200

$54.95

16-Piece Computer Kit

Do Your Own Repairs!
Save money by maintaining your computer yourself! Includes all the repair equipment you need. No computer enthusiast should be without one!

Cat T-4843



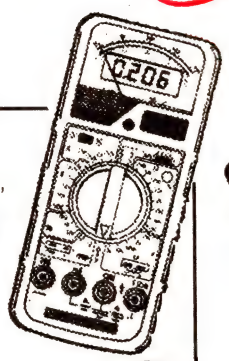
$49.95

Digital Multimeter with analogue display!

Now, you can read from both analogue and digital displays on the one compact multimeter! A sturdy design, it has both LCD digital and analogue displays for easy, accurate readouts, an easy-to-use rotary function switch, built-in exclusive microprocessor IC circuit and built-in overload protection circuit. Plus, it offers data hold (for analogue display only), high-input impedance and overload protection. Tests capacitance, frequency, transistors, diodes, continuity and temperature.

Specifications:
DCV: 200mV, 2, 20, 200, 1000V
ACV: 200mV, 2, 20, 200, 750V
AC/DC Current: 200uA, 2mA, 20mA, 200mA, 20A
Resistance (ohms): 200, 2K, 20K, 200K, 2000K, 20M

Cat Q-1702 **$215**

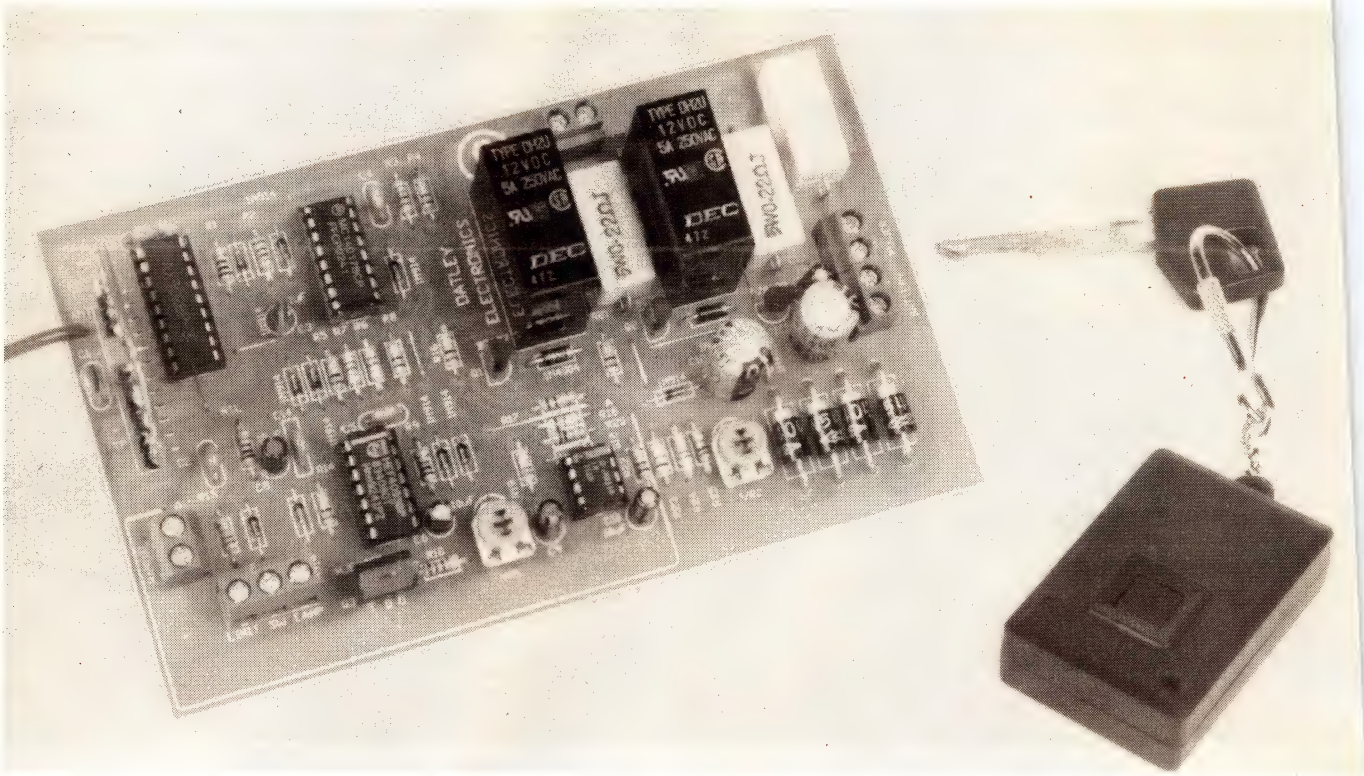


PHONE ORDERS
SYDNEY AREA 888 2105
OUTSIDE SYDNEY (FREE CALL) 008 22 6610

DICK SMITH ELECTRONICS

NSW • Albury 21 8399 • Bankstown Square 707 4888 • Blacktown 671 7722 • Brookvale 905 0441 • Bondi 387 1444 • Campbelltown 27 2199 • Chatswood Chase 411 1955 • Chullora 642 8922 • Gore Hill 439 5311 • Gosford 25 0235 • Hornsby 477 6633 • Hurstville 580 8622 • Kotara 56 2092 • Liverpool 600 9888 • Maitland 33 7866 • Miranda 525 2722 • Newcastle 61 1896 • North Ryde 878 3855 • North Sydney (Greenwood Plaza) 964 9467 • Orange 618 400 • Parramatta 689 2188 • Penrith 32 3400 • Railway Square 211 3777 • Sydney City 267 9111 • Tamworth 66 1711 • Wollongong 28 3800 **ACT**• Belconnen (06) 253 1785 • Fyshwick 280 4944 **VIC** • Ballarat 31 5433 • Bendigo 43 0388 • Box Hill 890 0699 • Coburg 383 4455 • Dandenong 794 9377 • East Brighton 592 2366 • Essendon 379 7444 • Footscray 689 2055 • Frankston 783 9144 • Geelong 232 711 • Melbourne City 399 Elizabeth St 326 6088 & 246 Bourke St 639 0396 • Richmond 428 1614 • Ringwood 879 5338 • Springvale 547 0522 **QLD** • Booval 282 6200 • Brisbane City 229 9377 • Buranda 391 6233 • Cairns 311 515 • Capalaba 245 2870 • Chermside 359 6255 • Maroochydore 791 800 • Rockhampton 27 9644 • Southport 32 9033 • Toowoomba 38 4300 • Townsville 72 5722 • Underwood 341 0844 **SA**• Adelaide City 232 1200 • Beverley 347 1900 • Elizabeth 255 6099 • Enfield 260 6088 • St Marys 277 8977 **WA** • Cannington 451 8666 • Fremantle 335 9733 • Perth City 481 3261 • Midland 250 1460 • Northbridge 328 6944 **TAS** • Hobart 31 0800 • Launceston 344 555 **NT** • Darwin 81 1977 **STORES ACROSS AUSTRALIA AND NEW ZEALAND**

B 1610



Remote controller for garage doors

The circuit presented here has all the required electronics for a garage door opener or other motorised device. It features a 304MHz UHF remote control transmitter, the receiver & decoding circuitry, door logic & motor switching relays.

Design by BRANCO JUSTIC

We last featured a remote controller for garage doors in the March and April 1991 issues of SILICON CHIP. This new project updates that design with completely new circuitry and the main PC board has fewer components on it too.

The main features of the circuit are provision for upper and lower limit door travel switches and over-current sensing for UP and DOWN modes of operation. This latter feature can be used to detect obstructions and immediately stop door operation to prevent damage to the motor, drive mechanism or possibly even your car.

The unit is based on a pre-built (and pre-aligned) UHF receiver module and features a small keyring transmitter that has more than half a million possible codes – 531,441 to be precise. You press the button on the transmitter and the door goes up; press it again and the door goes down – no more getting out of the car to open the garage door!

The circuit has provision for a manual switch which can be mounted somewhere on the wall inside the garage. This works in a similar way to the button on the transmitter: press it once for the door to go up and press it again to make the door go down. If you press the button before the door reaches the end of its travel, it will stop. You then have to press the button again to make the door go in the opposite direction. This applies also to operation via the transmitter.

Rather than re-invent the wheel, both the transmitter and the pre-built receiver front-end are the same as used in the UHF Remote Switch project that was featured in the December 1992 issue of SILICON CHIP. The front-

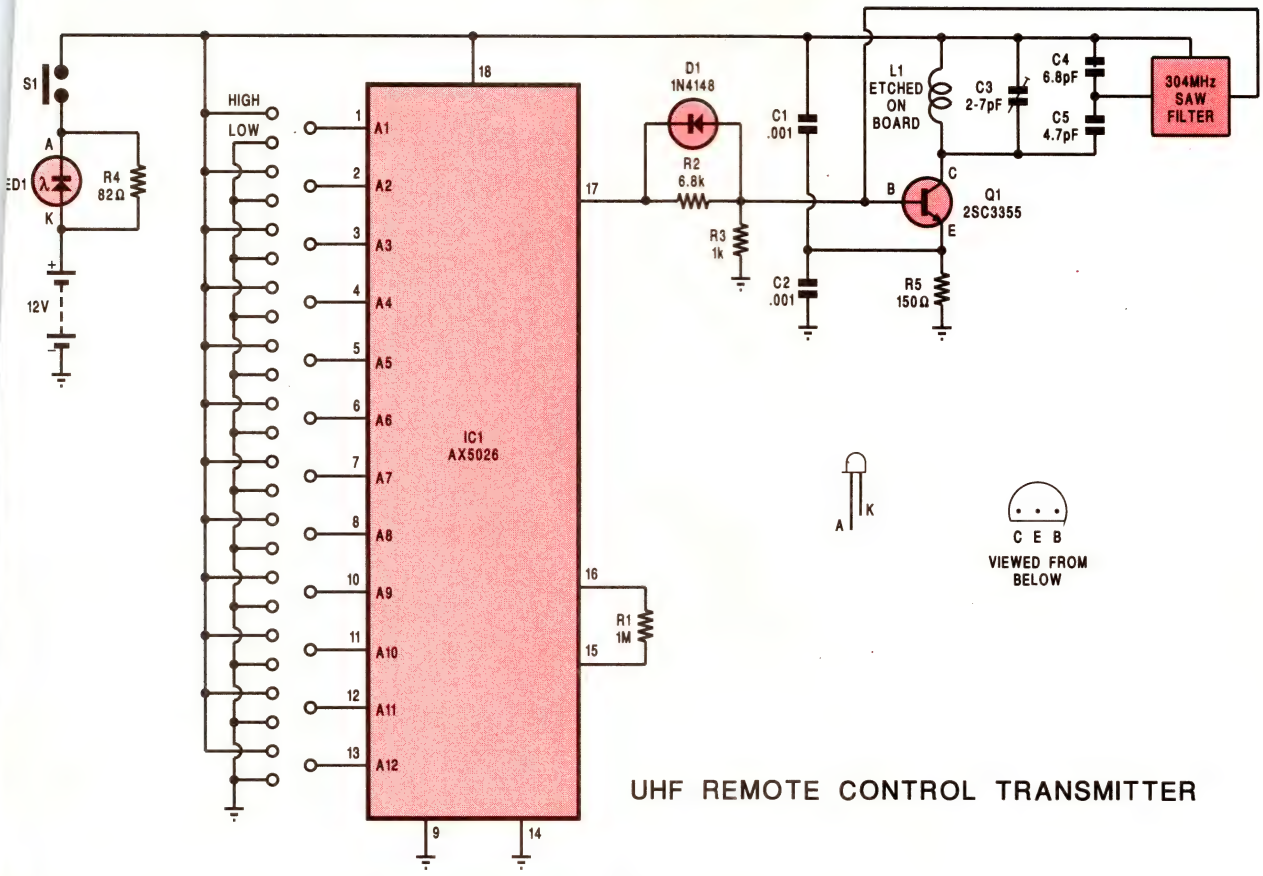


Fig.1: the transmitter is based on trinary encoder IC1. When S1 is pressed, IC1 generates a series of pulses at its pin 17 output to switch transistor Q1 on & off. This transistor is wired as an oscillator & operates at 304MHz due to its tuned collector load & the SAW filter in the feedback path.

end module of the receiver comes pre-aligned (to 304MHz) and uses surface mount components to give an assembly that measures just 35 x 25mm. It is fitted with a pin connector along one edge and plugs into the receiver PC board just like any other component. This eliminates alignment hassles and means that you don't have to wind any tricky coils.

How it works – transmitter

The transmitter is based on an AX-5026 trinary encoder IC – see Fig.1. When pushbutton switch S1 is pressed, this IC generates a sequence of pulses at its output (pin 17). The rate at which these pulses are generated is set by the 1MΩ timing resistor between pins 15 and 16 (R1), while the code sequence is set by the connections to the address lines (A1-A12).

Each of these address lines can be tied high, tied low or left open circuit (O/C), giving 531,441 possible codes.

The pulse coded output from IC1 drives RF transistor Q1. This transistor is connected as an oscillator and operates at 304MHz, as set by a tank circuit consisting of L1 (etched on the PC board), C3, C4 and C5. In addition, a SAW (surface acoustic wave) resonator is used to provide a narrow-band feedback path. Its lowest impedance is at its resonant frequency of 304MHz and thus the tuned collector load must be set to this frequency in order for Q1 to oscillate.

The SAW resonator ensures frequency stability and makes the transmitter easy to align. It ensures that the oscillator will only start and pulse LED 1 when the tuned circuit is virtually dead on frequency.

C3 is used to adjust the centre frequency of the tuned circuit. This point corresponds to maximum current consumption and is found by adjusting C3 to obtain peak brightness from the indicator LED (LED 1).

Power for the transmitter is derived from a miniature 12V battery (GP23 or equivalent) and this is connected in series with the pushbutton switch (S1). When S1 is pressed, the current drawn by the circuit is only a few milliamps, the exact figure depending on the code word selected at address lines A1-A12.

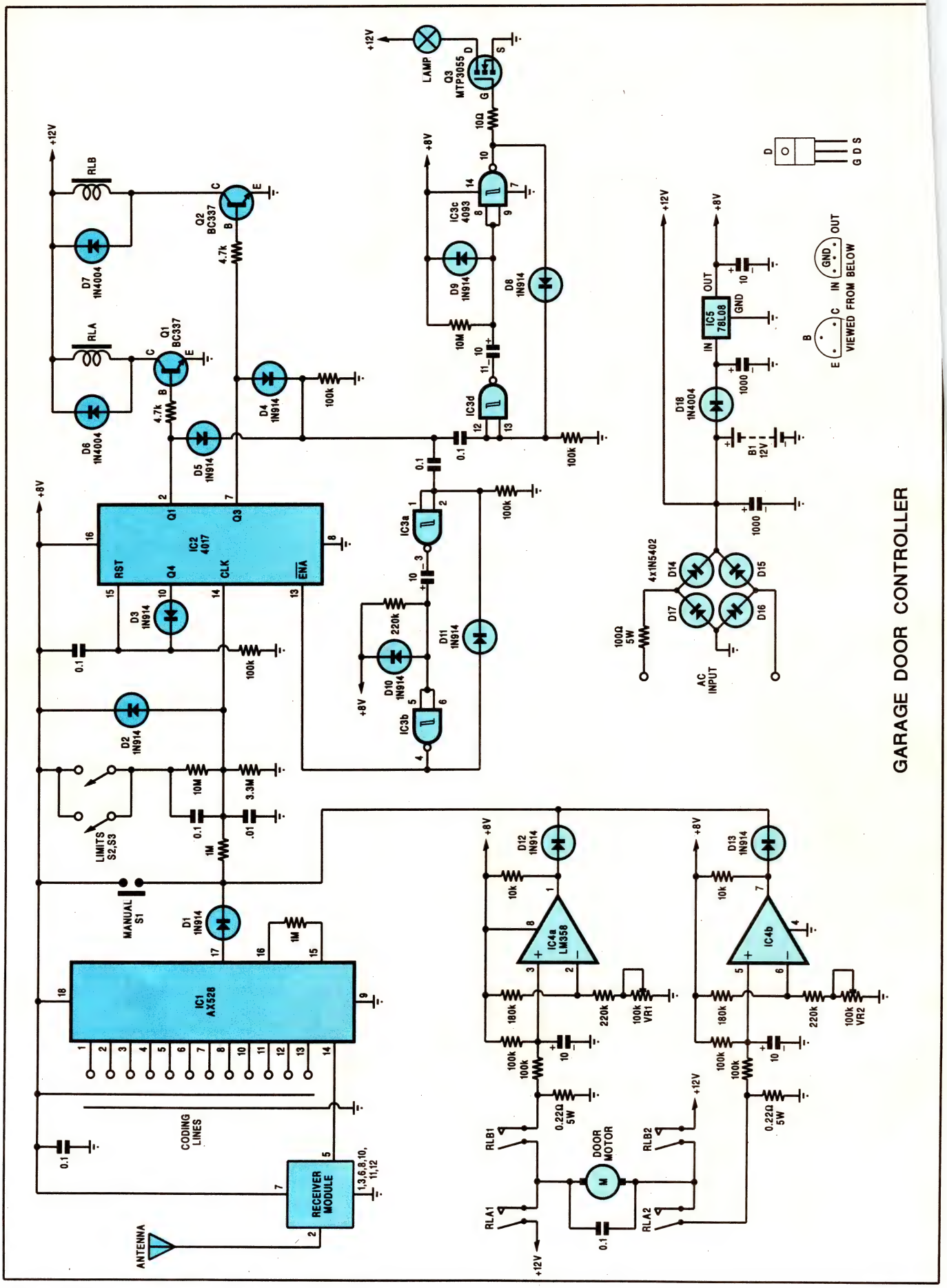
How it works – receiver

Fig.2 shows the circuit details of the receiver. Its job is to pick-up the coded RF pulses from the transmitter and decode these pulses to generate an output.

As already mentioned, the receiver is based on a complete "front-end" module. This processes the received signal via a bandpass filter, an RF preamplifier, a regenerative detector, an amplifier and a Schmitt trigger. Its input is connected to a short antenna, while its output delivers a digital pulse train to the input (pin 14) of IC1.

IC1 is an AX-528 Tristate decoder and is used to decode the 12-bit pulse signal that's generated by the transmitter. As with the AX-5026 encoder, this device has 12 address lines (A1-A12) and these are connected to match the transmitter code.

If the code sequence on pin 14 of IC1 matches its address lines, and the code sequence rate matches its timing (as set by R1), the valid transmission output at pin 17 switches high. This output connects via diode D1 to the


GARAGE DOOR CONTROLLER
+12V
+8V
LAMP
Q3 MTP3055
RLB
RLA
Q1 BC337
Q2 BC337
D1 1N914
D2 1N914
D3 1N914
D4 1N914
D5 1N914
D6 1N4004
D7 1N4004
D8 1N914
D9 1N914
D10 1N914
D11 1N914
D12 1N914
D13 1N914
D14 4x1N5402
D15
D16
D17
D18 1N4004
IC1 AX528
IC2 4017
IC3a
IC3b
IC3c 4093
IC3d
IC4a LM358
IC4b
IC5 78L08
LIMITS S2,S3
MANUAL S1
CODING LINES
RECEIVER MODULE
ANTENNA
DOOR MOTOR
RLB1
RLB2
RLA1
RLA2
AC INPUT
B1 12V
VIEWED FROM BELOW
GND
IN
OUT

PARTS LIST

Transmitter
1 transmitter case
1 PC board, 30 x 37mm
1 miniature PC-mount pushbutton switch
1 12V battery, GP23 or equivalent
1 304MHz SAW resonator

Semiconductors
1 AX-5026 trinary encoder (IC1)
1 2SC3355 NPN transistor (Q1)
1 1N4148 silicon diode (D1)
1 3mm red LED (LED1)

Capacitors
2 .001µF ceramic
1 6.8pF ceramic
1 4.7pF ceramic
1 2-7pF miniature trimmer

Resistors (0.25W, 5%)
1 1MΩ 1 150Ω
1 6.8kΩ 1 82Ω
1 1kΩ

Receiver
1 PC board, 144 x 87mm
1 front-end module (aligned to 304MHz)
2 12V DPDT relays
1 momentary contract pushbutton switch (S1)
2 microswitches (S2,S3)
1 12V SLA battery
1 12V lamp
4 2-way insulated terminal blocks
1 3-way insulated terminal block
2 100kΩ trimpots (VR1,VR2)

Semiconductors
1 AX-528 tristate decoder (IC1)
1 4017 decade counter (IC2)
1 4093 quad Schmitt NAND gate (IC3)
1 LM358 dual op amp (IC4)
1 78L08 3-terminal regulator
2 BC337 NPN transistors (Q1, Q2)
1 MTP3055 Mosfet (Q3)
4 1N5404 rectifier diodes (D14-D17)
11 1N914, 1N4148 signal diodes (D1-D5,D8-D13)
3 1N4004 rectifier diodes (D6,D7,D18)

Capacitors
2 1000µF 16VW PC mount electrolytic
5 10µF 16VW PC mount electrolytic
6 0.1µF monolithic
1 .01µF monolithic

Resistors (0.25W, 5%)
2 10MΩ 2 10kΩ
1 3.3MΩ 2 4.7kΩ
2 1MΩ 1 100Ω 5W
3 220kΩ 1 10Ω
2 180kΩ 2 0.22Ω 5W
8 100kΩ

Where to buy the parts
A kit of parts for this garage door controller is available from Oatley Electronics, PO Box 89, Oatley, NSW 2223,Australia. Phone (02) 579 4985. The prices are as follows: (1) Receiver kit (PC board and all on-board components) $79; (2) Transmitter kit (including case & battery) $19; (3) 17V AC plugpack $18. Add $2.50 for postage & packing.

clock input (pin 14) of IC2, a 4017 decade counter.

This counter can also be clocked by manual switch S1 and by limit switches S2 and S3. The length of the clock pulses produced by the operation of S2 and S3 is limited by the time constant of the associated 0.1µF capacitor and 3.3MΩ resistor. The .01µF capacitor filters out any noise picked up by the wires used to connect S1, S2 and S3, while the 10MΩ resistor discharges the 0.1µF capacitor after S2 or S3 has been operated.

Fig.2 (left): the heart of this circuit is IC1 & IC2. IC1's output at pin 17 goes high when a valid code is detected. Pin 17 then clocks IC2 which controls the switching of relays RLA & RLB via transistors Q1 & Q2. IC4a & IC4b provide over-current monitoring & they can clock IC2 into a STOP mode whereby the relays are not energised. IC3d, IC3c & Q3 light the lamp for about two minutes after the transmitter button is pressed.

Note that when the power is first applied, IC2 is reset by a short pulse on the reset line, by virtue of the 0.1µF capacitor connected to the +8V supply line. The counter is also reset when its Q4 output goes high; a pulse is applied to the reset input via diode D3. This means that IC4 can only have four exclusive output states: Q0 high, Q1 high, Q2 high or Q3 high.

Outputs Q0 and Q2 do not drive anything so they correspond to "Stop" modes while outputs Q1 and Q3 switch the "Up" and "Down" relays (via transistors Q1 & Q2). Thus, a succession of clock pulses from decoder IC1 correspond to the following modes: Stop, Up, Stop, Down, Stop, Up, etc.

Two separate over-current detectors, comprising op amp comparators IC4a and IC4b, detect higher than normal motor currents that would result when the door reaches its Up or Down stop positions or if the door is obstructed. The outputs of these over-current detectors then apply a pulse to the clock input of IC2, which causes it to go into the Stop mode.

The counter can be disabled from clocking by its ENA-bar input being held at "0". The output of the monostable comprising Schmitt NAND gates IC3a & IC3b is normally high, thus enabling the counter to clock. However, this monostable is triggered via isolating diodes D4 & D5 each time Q1 (up) or Q3 (down)of IC2 first go high.

This monostable therefore prevents the counter from stepping for approximately two seconds after the Up or Down modes are first activated. This two-second disabling of the counter prevents it being triggered by the over-current detectors, which would otherwise happen since a motor draws relatively high currents when it first starts up.

Courtesy lamp driver

A second monostable made up of gates IC3c & IC3d is used to switch a lamp via Mosfet Q3. This monostable is also operated via diodes D4 and D5 each time Q1 (up) or Q3 (down) of IC2 goes high. The time constant of the monostable causes the lamp to light for just under two minutes.

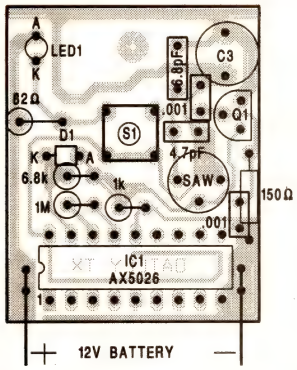
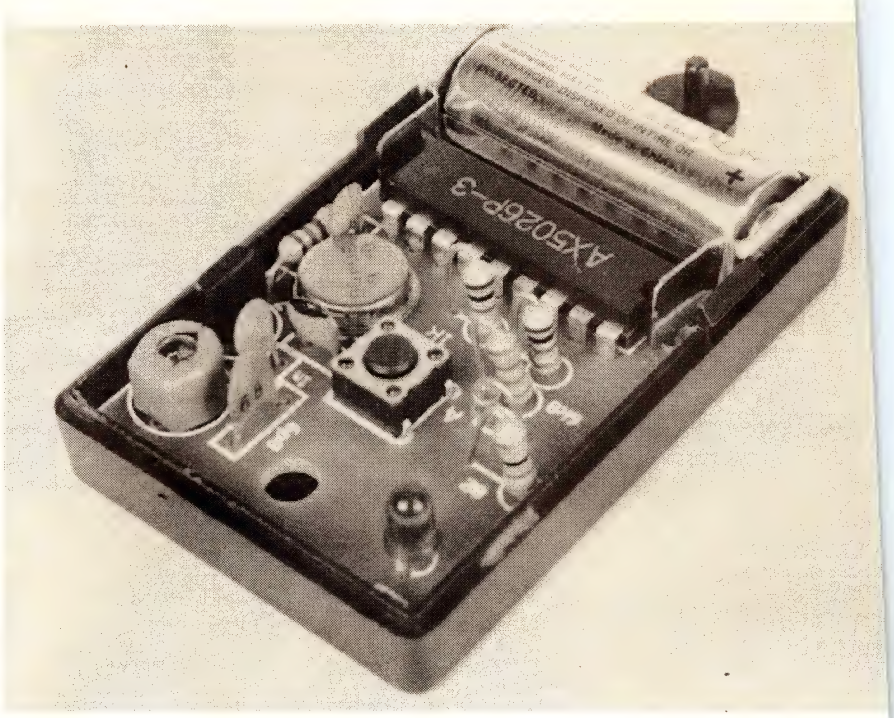


Fig.3: keep all leads as short as possible when installing the parts on the transmitter PC board & take care with the orientation of the encoder IC.



A combination of a 12V battery and a 17V 1A AC plugpack are used to power the controller. The 100Ω 5W resistor in series with the bridge rectifier limits the charging current to the battery. Note that the two 1000µF capacitors in the power supply are rated at 16VW but if the 12V battery is not present that voltage rating will be exceeded.

A 7808 3-terminal regulator provides a +8V supply for the receiver, decoder and op amps, while the relays and motor are driven directly from the 12V battery. Note that each relay has two pairs of contacts to connect the motor across the 12V supply in one direction or the other. The system is fail-safe since only one relay can be energised at a time and when the circuit is in Stop mode, both relays are de-energised and the motor is isolated from the 12V battery.

Construction

Let's discuss the transmitter first. The component layout for the PC board is shown in Fig.3. All the parts, including the battery terminals and the switch (S1), are mounted on a small PC board which fits inside a plastic transmitter case.

Before mounting any of the parts, you must first file the edges of the PC board so that it will fit in the case. This also removes two shorting strips. One of these strips runs along the bottom of the board, while the other runs down the righthand edge (as viewed from the copper side). Make sure that these two shorting strips are completely filed away; if they are not, the battery terminals will be shorted and the positive battery terminal will be shorted to C3.

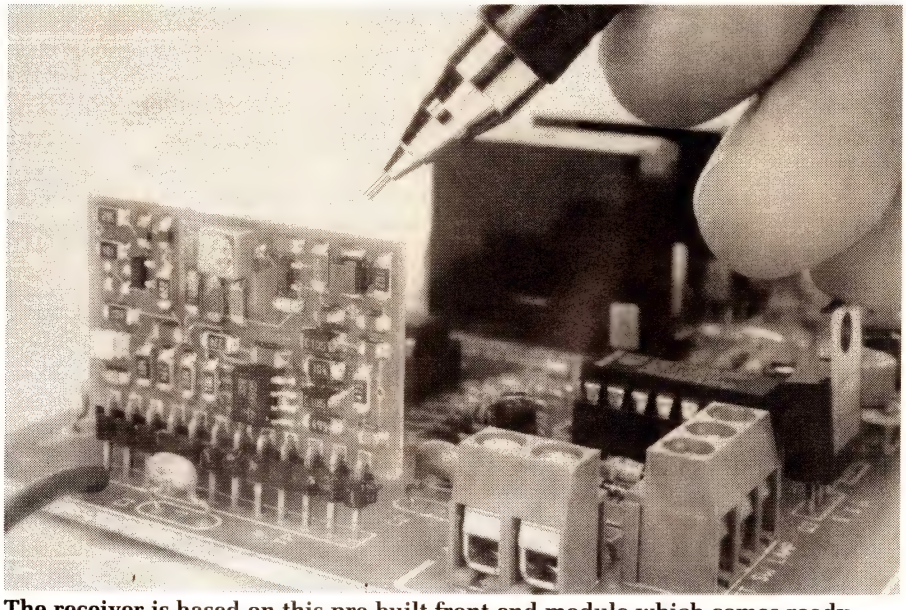
The most important thing to remember with the transmitter assembly is that all component leads should be kept as short as possible. Apart from that, it's simply a matter of installing the parts as shown in Fig.3.

Be sure to orient IC1 correctly and note that the flat side of the trimmer capacitor (C3) is adjacent to one end of the board. The SAW resonator and switch should both be mounted flat against the board, while the transistor should only stand about 1mm proud of the board.

Take care when mounting the switch – it must be correctly oriented, otherwise it will appear as a short and the transmitter will be on all the time (the switch will only fit comfortably in one direction).

The LED should be mounted with its top about 7mm proud of the board, so that it later protrudes about halfway through a matching hole in the lid. Be careful with the orientation of the LED – its anode lead is the longer of the two.

Check the board carefully when the



The receiver is based on this pre-built front-end module which comes ready aligned & tuned to 304MHz. It is soldered into place on the PC board just like any other component.

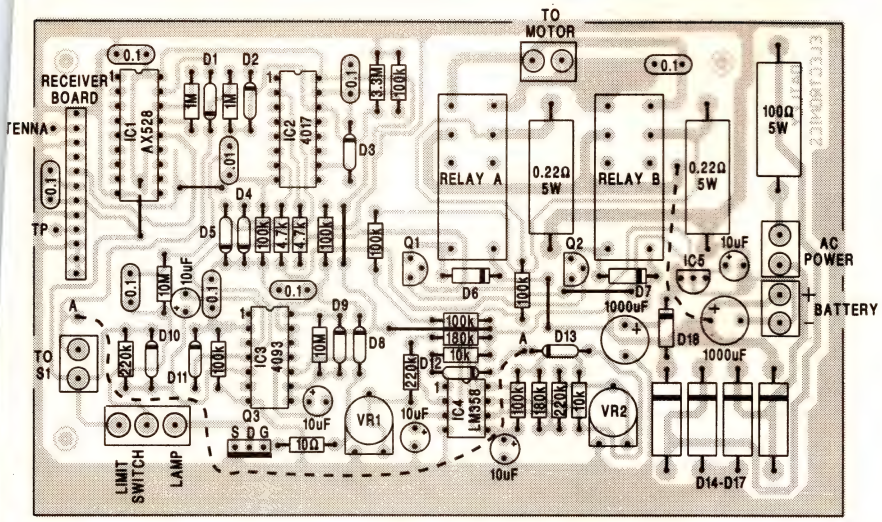


Fig.4: the front-end module is installed on the receiver PC board with its component side facing the adjacent 0.1µF capacitor. Don't forget to install the two insulated wire links (shown dotted) on the copper side of the PC board.

assembly is completed – it only takes one wrong component value to upset the circuit operation. This done, slip the board into the bottom half of the case, install the battery and test the circuit by pressing the switch button.

Don't worry if the LED doesn't flash at this stage – that probably won't occur because Q1 will not be oscillating. To adjust the oscillator stage, press the switch and tune C3 using a plastic tool until the LED does start to flash. When this happens, the oscillator is working and you can tweak C3 for maximum transmitter output (ie, maximum LED brightness).

The lid of the case can now be snapped into position and secured using the small screw supplied.

Receiver assembly

Fig.4 shows the parts layout on the receiver board. Install the parts exactly as shown, leaving the receiver module till last. This module must be installed with its component side away from the AX528 decoder (IC1).

Do not forget to install the link underneath IC1 or the insulated link which runs from the anode of D18 to the commoned connection to the two relays (+12V). A second insulated link runs from the cathode of D13 to point A below the front-end module.

The antenna consists of a length of insulated hook-up wire and can be either 250mm or 500mm long. The latter will give slightly greater range.

When the receiver assembly is complete, check all your work carefully to see that it agrees with the wiring diagram of Fig.4. This done, apply power and use your DMM to check that pin 17 of the AX528 switches high when the transmitter button is pressed.

Coding

Initially, all the A1-A12 address lines will be open circuit but you can tie selected address pins high or low by connecting them to adjacent copper tracks. In both cases, a +5V rail runs adjacent to the inside edge of the address pins, while a ground track runs around the outside edge of the address pins.

For example, you might decide to tie A1 and A8 high, tie A3 and A6 low, and leave the rest open circuit. Short wire links can be used to make the connections but note that you will have to scrape away the solder mask from the supply rail at each connection point so that the track can be soldered. Make sure that the transmitter code matches the receiver code otherwise the remote control won't work.

Note that the over-current setting trimpots (VR1 & VR2) are set during installation of the door mechanism. Full instructions on installation and typical mechanisms were featured in the April 1992 issue. **SC**

RESISTOR COLOUR CODES

❑	No.	Value	4-Band Code (1%)	5-Band Code (1%)
❑	2	10MΩ	brown black blue brown	brown black black green brown
❑	1	3.3MΩ	orange orange green brown	orange orange black yellow brown
❑	3	1MΩ	brown black green brown	brown black black yellow brown
❑	3	220kΩ	red red yellow brown	red red black orange brown
❑	2	180kΩ	brown grey yellow brown	brown grey black orange brown
❑	8	100kΩ	brown black yellow brown	brown black black orange brown
❑	2	10kΩ	brown black orange brown	brown black black red brown
❑	1	6.8kΩ	blue grey red brown	blue grey black brown brown
❑	2	4.7kΩ	yellow violet red brown	yellow violet black brown brown
❑	1	1kΩ	brown black red brown	brown black black brown brown
❑	1	150Ω	brown green brown brown	brown green black black brown
❑	1	100Ω 5W	not applicable	not applicable
❑	1	82Ω	grey red black brown	grey red black gold brown
❑	1	10Ω	brown black black brown	brown black black gold brown
❑	2	0.22Ω 5W	not applicable	not applicable

Build this low-voltage LED stroboscope

If you need to measure the speed of rotating machinery in revs per minute, try this new low-voltage LED stroboscope. It uses pulsed high-intensity LEDs as the light source to stop motion & gives a readout of the RPM on a 3-digit LED display.

By DARREN YATES

Have you ever had to measure the speed of rotating machinery? Unless your head is mounted on a 360 degree swivel axis and has an inbuilt rev counter, it's quite a difficult job – without a stroboscope, that is!

There are all sorts of situations where a stroboscope is a useful tool. Typical applications include calibrating and checking motor speed controllers in industry, measuring engine idle speed in model aircraft, and checking the speed of lathes and other rotating machinery.

A stroboscope is also useful as a diagnostic tool because it can effectively slow down motion. Many machines operate at a pace that's faster than the eye can see, so when a malfunction occurs it can be difficult to locate the source of the problem. However, by using a stroboscope that runs slightly out of sync with the machine being monitored, it's possible to slow the motion down so that the eye can actually follow what is happening.

For example, newspapers coming off a printing press are automatically folded by a machine that works at high speed. Because of this, it can be very difficult to locate the exact cause of any problems, such as paper tearing. By using a stroboscope, it's possible for the operator to visually "slow" the machine down, locate the problem and make the necessary adjustments to correct the problem.

The concept behind a stroboscope is easy enough to understand. It's basically a device that emits a high-intensity flash of light at a set interval. The frequency of these flashes is usually adjustable by means of a potentiometer. In this unit, the flash frequency can be set anywhere from 1Hz to 317Hz – a range that effectively covers from 60-19,000 RPM.

In order to measure RPM, the strobe light is pointed at a white dot or line painted on the axis of the machine. The flash frequency is then adjusted until the white dot appears to be stationary (equivalent to one flash per rev) and the speed of the machine

d off the digital display directly in M.

There's just one point to watch out here – the dot (or line) will also pear to be stationary if the strobe shes at some exact multiple or frac-n of the rev rate (eg, twice per rev or ce every two revs). For this reason, s always necessary to use the flash tting at which the line is brightest hen it appears stationary.

Slow motion effects are made pos-ble by adjusting the flash frequency o that it is slightly out of sync with he machine being monitored. This as the effect of making the machine ppear to be in slightly adjacent posi-ons for each successive flash, even hough it may have gone through sev-ral cycles between flashes. As a re-ult, the machine appears to run in low motion.

Adjusting the stroboscope to give low motion effects is not as difficult as it sounds. You simply aim it at the machine and rotate the pot for the desired effect.

In most stroboscopes, the active flashing element is an xenon tube. But although this is capable of producing a bright light, it does require a high voltage to drive it – typically around 350V or so. This high voltage is usually derived by charging up a capacitor which is then discharged via the xenon tube when it is triggered by a pulse transformer. The main drawback of this technique is that the high voltage required to fire the tube is dangerous.

Certainly, the voltage that appears across the main discharge capacitor is potentially fatal, so due care must be exercised in the design and construction of such devices.

High-brightness LEDs

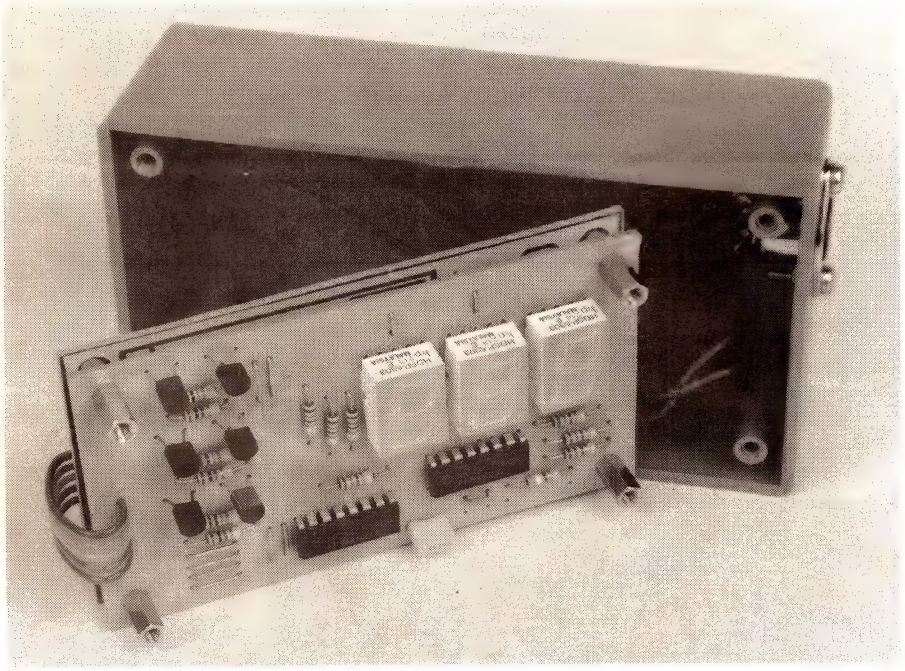
By contrast, this design is completely safe because there are no high voltages involved. This has been achieved by eliminating the xenon tube and substituting an array of high-brightness LEDs instead. The whole circuit runs off a 12V DC plugpack supply, so high-voltage mains wiring is also eliminated.

The LEDs specified are 5mm red high-intensity types which are available from Altronics (Cat. Z 0149) for 50 cents each in quantities of 10 or more. They have a brightness of about 1000mCd and are arranged in a circular pattern inside a torch body.

By the way, all stroboscopes work best in subdued light conditions. They can't work in bright light because you cannot see the flashes.

How it works

Fig.1 shows the circuit details of the LED Stroboscope. It's virtually identical to the Digital Voltmeter for



This view shows the control module of the LED Stroboscope. It consists of two PC boards which are stacked back-to-back on 5mm spacers & secured to the lid of the case. The three LED displays are viewed through a Perspex window.

PARTS LIST

1 PC board, code 04112931, 100 x 55mm
1 PC board, code 04112932, 100 x 55mm
1 PC board, code 04112933, 53mm diameter
1 plastic zippy case, 130 x 67 x 42mm
1 front panel label
1 torch case (see text)
1 12VDC 500mA plugpack
1 2.1mm DC socket
1 5-pin DIN plug
1 5-pin DIN socket
1 1-metre length of 3-pair telephone cable
4 10mm x 3mm tapped spacers
4 5mm untapped spacers
1 100mm length of 0.1-inch spaced ribbon cable
1 10kΩ log potentiometer (VR1)
1 1MΩ 5mm horiz. trimpot (VR2)

Semiconductors

1 LM358 dual op amp (IC1)
1 4049B hex inverter (IC2)
1 MC14553 3-digit counter (IC3)
1 4511 7-segment display driver (IC4)
1 BC548 NPN transistor (Q1)
3 BC557 PNP transistors (Q2,Q4,Q6)
3 BC337 NPN transistors (Q3,Q5,Q7)
1 BD679 NPN Darlington transistor (Q8)
1 1N4004 diode (D1)
1 7809 3-terminal regulator
3 HDSP-5303 7-segment common-cathode displays
31 high-brightness LEDs (LEDs1-31) (Altronics Cat. Z-0149 or equivalent)

Capacitors

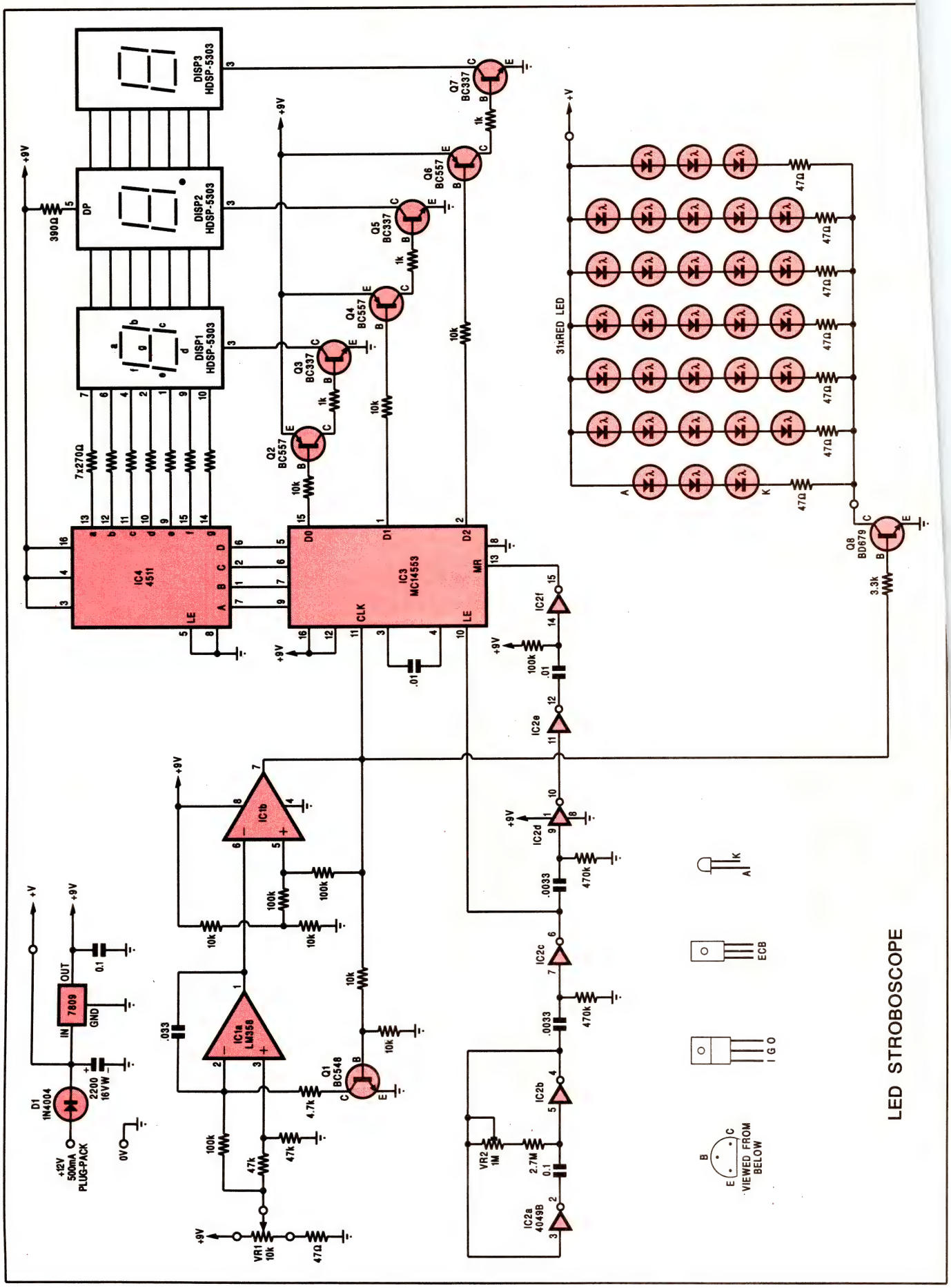
1 2200µF 16VW electrolytic
2 0.1µF 63VW MKT polyester
1 .033µF 63VW MKT polyester
2 .01µF 63VW MKT polyester
2 .0033µF 63VW MKT polyester

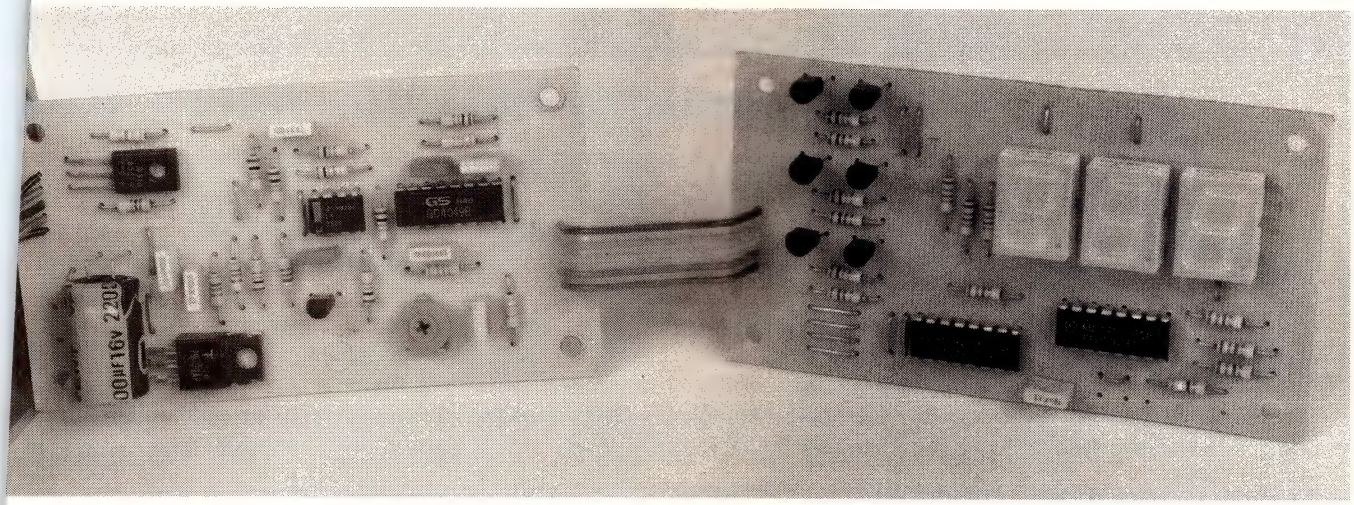
Resistors (0.25W, 1%)

1 2.7MΩ	1 3.3kΩ
2 470kΩ	3 1kΩ
4 100kΩ	1 390Ω
2 47kΩ	7 270Ω
7 10kΩ	8 47Ω
1 4.7kΩ	

Miscellaneous

Solder, screws, nuts & washers


LED STROBOSCOPE
DISP3 HDSP-5303
DISP2 HDSP-5303
DISP1 HDSP-5303
DP
390Ω
7x270Ω
IC4 4511
IC3 MC14553
D0
D1
D2
CLK
LE
MR
Q1 BC548
Q2 BC557
Q3 BC337
Q4 BC557
Q5 BC337
Q6 BC557
Q7 BC337
Q8 BD679
31xRED LED
47Ω
10k
1k
3.3k
100k
470k
4.7k
47k
2.7M
1M
.01
.033
.0033
0.1
2200 16VW
IC1a LM358
IC1b
IC2a 4049B
IC2b
IC2c
IC2d
IC2e
IC2f
VR1 10k
VR2 1M
D1 1N4004
+12V 500mA PLUG-PACK
7809
IN
OUT
GND
+V
+9V
0V
A
K
ECB
I G O
B
E
C
VIEWED FROM BELOW



he VCO board (left) & the counter board (right) are joined together via a 0mm-length of 5-way rainbow cable. This allows the two boards to be "folded" ogether so that they can be stacked on 5mm spacers. Note how the 2200µF apacitor on the VCO board is mounted (bottom left).

Cars published in the June 1993 issue, lespite the fact that the two projects perform totally different functions.

VCO operation

Op amps IC1a and IC1b (LM358) are connected to form a voltage controlled oscillator (VCO). IC1a is wired as an integrator while IC1b acts as an inverting Schmitt trigger. In operation, IC1a's output (pin 1) ramps up and down due to the presence of Schmitt trigger IC1b and transistor Q1 in its negative feedback loop.

When power is first applied, IC1a's output ramps down linearly until it reaches the lower threshold of IC1b (about 3V). At this point, pin 7 of IC1b goes high and turns on Q1. This pulls pin 2 of IC1a low via a 4.7kΩ resistor and so the voltage on pin 1 rises as the .033µF capacitor charges in the opposite direction. When it reaches the upper threshold of the Schmitt trigger (about 6V), pin 7 of IC1b switches low again and Q1 turns off. Pin 1 of IC1a now ramps down again and so the cycle continues indefinitely.

As a result, a sawtooth waveform appears on pin 1 of IC1a, while a corresponding pulse waveform appears at pin 7 of IC1b. This pulse waveform has a duty cycle of about 5%, as set by the ratio of the 4.7kΩ and 100kΩ resistors on pin 2 of IC1a. Its repetition rate is directly proportional to the input voltage set by VR1 – the higher the voltage on VR1's wiper, the higher the output frequency.

The output from the VCO is used to switch Darlington transistor Q8 (BD679) and this in turn drives the LED array. Thus, each time pin 7 of IC1b goes high, Q8 turns on and lights the LEDs.

The LED array consists of 31 high-brightness LEDs, arranged in five lines of five series LEDs plus two lines of three series LEDs. A 47Ω current limiting resistor is fitted in series with each line of LEDs to limit the pulse current through them to a safe value. This current is quite high but is still within the LED ratings due to the short duty cycle.

Counter circuit

As well as driving the LED array, the VCO also directly drives a counter circuit with a 3-digit LED readout. This counter measures the VCO frequency and is calibrated to read directly in RPM.

In greater detail, the pulse waveform at pin 7 of IC1b clocks pin 11 of IC3, a CMOS 4553 3-digit counter. This IC contains three separate decade counters, as well as the necessary output latches and multiplexing circuitry for three 7-segment LED displays. The .01µF capacitor between pins 3 & 4 sets the frequency of an internal oscillator and this in turn sets the speed at which the outputs are multiplexed.

The BCD outputs appear at pins 5, 6, 7 & 9 and are decoded using IC4, a CMOS 4511 7-segment display driver. This IC converts the 4-bit BCD code from IC3 into 7-segment outputs which then directly drive the LED displays via 270Ω current limiting resistors. Each display is switched on at the correct time by the D0-D2 digit driver outputs from IC3. These outputs switch the displays via PNP/NPN transistor pairs Q2-Q7.

IC2 provides the required latch enable (LE) and memory reset (MR) timing signals for IC3. IC2a and IC2b are used to form a standard square-wave oscillator. Its output frequency can be adjusted using VR2, which provides calibration.

Each time pin 4 of IC2b switches high, pin 6 of monostable stage IC2c switches low and this provides the LE pulse for IC3. Each time a pulse is received, the current count in IC3 is latched into the output registers and the display is updated.

After latching, the counters inside IC3 must be reset so that a new count can begin. This task is performed by the MR pulse and this is obtained by feeding the output from IC2c through a delay circuit consisting of stages IC2d-IC2f.

Normally, pin 12 of IC2e is low but when pin 6 goes high at the end of the LE pulse, pin 12 also goes high for a

Fig.1 (left): the complete circuit of the LED Stroboscope. IC1a & IC1b form a VCO, with VR1 setting the output frequency. The pulse output appears at pin 7 of IC1b & drives an array of high-brightness LEDs via Darlington transistor Q8. It also clocks pin 11 of IC3, a 3-digit counter. IC4 decodes the counter outputs &, together with IC3, drives three 7-segment LED displays to show the speed of the rotating object in RPM.

ALTRONIC COMPONENTS • Jet Express • AUSTRALI WIDE

Our Competitors Hate Us - Here's Why

One reason Altronics competitors are unhappy with us is because we deliv your order the very next day*. On top of this our fine products are often n dearer than the "hobby grade" components offered elsewhere.
Phone Free Call 008 999 007 for prompt and courteous attention every time

Regards Jack O'Donnell

* Weekends and country areas please add 24 - 48 hours

ALTRONIC COMPONENTS

Beat Triggered Strobe Kit

(AEM July '85) Designed by Australian Electronics Monthly. Flashes in time to your music. Will also work as normal strobe. Exclusively customised by Altronics into our H 0480 Instrument Case, making construction a breeze and improving stability, safety and overall appearance. Includes silk screened panel. Two tube option available which boosts lighting output.

K 5790 Strobe Kit Normally $79.95

This Month Only $75

K 5795 Two Tube Option **$16.50**

DiscoLite Chaser & Colour Organ Kit

(SC July-Aug '88) The Discolite flashes party lights on and off in beat with music from your amplifier. **Features:** • 4 light channels controlled by 4 separate audio channels • Forward reverse and auto-reversing chaser patterns • Simultaneous strobe on all four channels • Alternating light patterns • Music modulation available on chaser strobe and alternate patterns • Inbuilt microphone or direct inputs for beat triggering or audio modulation of lights • Sensitivity control • Individually pre-settable sensitivity levels for each channel • Front panel LEDs mimic light display • Altronics Kit pre-punched and silk screened

K 5805 **$159.50**

Impedance Meter

Have you ever wondered if a transformers has a shorted turn and not been able to prove it. Or is that speaker transformer on the correct tapping. Well this little meter can now do that with digital reliability.

NEW

K 2550 Kit Version **$79.95**

K 2551 Fully Built-Up Version **$119.95**

High Energy Ignition System Kit

Keep Your Car In Top Tune. Save Money on Petrol, Plugs & Points & Increase Performance!

(SC May '88) This "state of the art" electronic ignition system uses the same semi-conductors as found in modern motor car ignitions. Extends the life of plugs and points. Increases power and improves fuel economy. Compatible for 4, 6 and 8 cylinder engines. Uses dedicated Motorola IC. Install one into your car and start saving $$$ from the very first day. Comes with full explanation of your vehicle's ignition system.

K 4015 **$58.50**

New High Performance Series Mosfets

This new range is a direct replacement for the now discontinued Hitachi mosfet range, making them ideal for amplifiers etc. Call Altronics for full specifications.

Manufactured in the UK to Military Specifications!

Specifications Z 1450-Z 1456:
Drain Source Voltage: 160V
Gate Source Voltage: .....±14V
Drain Current:.....8A
Body Drain Diode: 8A
Total Body Dissipation: ...125W

Specifications Z 1470-Z 1476:
Drain Source Voltage: 160V
Gate Source Voltage: .....±14V
Drain Current:.....16A
Body Drain Diode: 16A
Total Body Dissipation: ...250W

NEW

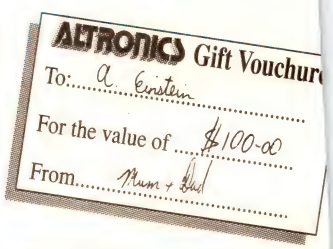
Z 1450 2SK134	$16.95
Z 1452 2SJ49	$17.75
Z 1454 2SK176	$19.50
Z 1456 2SJ56	$19.95
Z 1470 2SK135*	$28.85
Z 1472 2SJ50*	$29.25
Z 1474 2SK176*	$32.25
Z 1476 2SJ56*	$32.95

* N.B. These models are now high current ratings

Direct Replacements for the Hard to find 2SK & 2SJ Series!

Altronics Gift Vouchers

A Great Christmas or Birthday gift, for that budding genius son of yours. Redeemable any time throughout 1993/94.

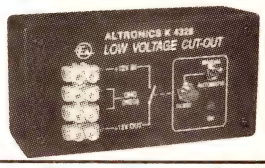


Low Voltage Cut-Out for Cars and Boats Kit

Adjustable Cutout Variable from 10.9V to 11.9V. Includes Automatic or Manual Voltage Reset Function.

(SC Jan '92) Build this simple little device, and avoid getting caught out with a flat battery during your holidays. It simply connects into a 12V accessories power line, and shuts off the flow if the battery voltage drops to a dangerously low level. Ideal for battery powered camping fridges etc.

K 4328 **$24.95**



Low Cost "Karaoke" Adaptor Kit

(EA Nov '91) It's time to bring out all those hidden vocal talents that you've always known were there. With this project you can remove the lead vocal from almost any recording, and replace it with your own via a standard microphone. It's a great way to liven up a party! This project works on the assumption that the lead vocal in most stereo recordings has been placed mid-way between the left and right channels, or is in fact a mono signal. Requires 2 x 9V batteries.

K 1170 Normally $34.95

This Month $29

Simply Connects in line Between CD or Tape Deck & Amp

Video Fader Kit

Here is a fantastic kit which allows you to create great fades and wipes when editing on your VCR. It can wipe left and right as well as fade to black or white. Complete with professional screen printed front panel and manual controls for fades and wipes. Simply plugs in between the two video machines when recording from one to the other.

K 5870

$32.95

NEW

Makes Professional Fades & Wipes When Editing Videos

Compact Stereo 50 + 50W Amplifier Kit

This fantastic amp has all the features of commercial units costing hundreds of dollars more. Using TIP 142/147 transistors it is capable of producing a total of 47 Watts per channel RMS into 8 ohms. Features 6 inputs, bass, treble and balance controls, headphone jack, tone defeat switch etc etc. Incorporates polyswitch protection.

Impress Your Friends with this Quality Stereo Home Amplifier!

K 5045 Normally $299.00, **This Month Only $250.00**

PHONE ORDER - FREECALL 008 999 007

-0-45V Toroidal ansformers

VA rating. Two ondary windings, can be wired give 90V at 1.78 ps, or 45V at 3.56 ps. Ideal for plifiers etc. etc.

3080 Normally $65.00

is Month Only $55.00

Only While Stocks Last!

60-0-60V Toroidal Transformers

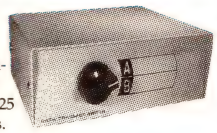
500VA rating. Two secondary windings, can be wired to give 120V at 4.1 amps, or 45V at 8.3 amps. Ideal for amplifiers etc. etc.

M 3150 Normally $129.00

This Month Only $110.00

Only While Stocks Last!

A-B Switch Box D25-D25

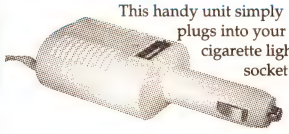


Two way printer-peripheral-computer switch with D25 female sockets. Allows two printers to be run off one computer and individually selected or allows one printer to be run off two computers and individually selected.

D 1570 Normally $49.95

This Month Only $39.95

Car Voltage Adaptor

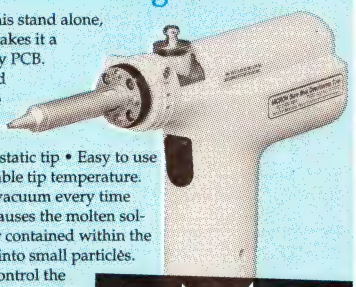


This handy unit simply plugs into your car's cigarette lighter socket and presto! Gives you switchable 3, 4.5, 6, 7.5, 9 and 12V DC at up to 800mA. Includes a range of output plugs. Reversible polarity. Great for pocket TV's etc.

M 8150 Normally $16.95

This Month Only $12.95

Micron Sure Shot Desoldering Tool



Exclusive to Altronics in Australia. This stand alone, fully self-contained desoldering tool makes it a breeze to remove components from any PCB. Even double sided, through hole plated boards. All it needs is a squeeze or two on the trigger and the component virtually falls out. **Features:** • Totally self contained • Light and compact • Anti static tip • Easy to use • Simple to clean and maintain • Variable tip temperature. The ***Sure Shot*** generates a high speed vacuum every time the trigger is squeezed. This vacuum causes the molten solder to flow into the collection reservoir contained within the unit. Here the molten solder solidifies into small particles. With its inbuilt variable temperature control the ***Sure Shot*** is ideal for single sided, double sided and through hole plated P.C.B.'s. With just a couple of squeezes of the trigger all holes are left solder-free for easy removal of the component.

T 1270 $349.00

T 1272 Replacement Tip to Suit $45.00

T 1275 Replacement Filters to Suit $24.95

Mention This Ad & Receive a Free Bench Stand. Valued at $24.95! (Offer not available at Altronic Resellers)

Amazing AA NiCad Battery Bargain

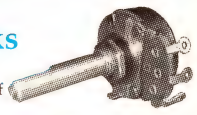
Premium grade quality. AA size only. 500mA capacity. Great for those battery hungry toys, cassette players etc.

S 5020 AA Size Normally $3.95

This Month Only $2.95 ea

or $2.50 ea 10 up

Pot Packs

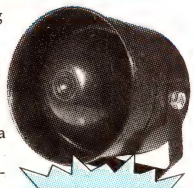


We have a surplus of quality of discontinued potentiometers. All are standard values, ie. 1k, 5k, 10k, 20k, 50k, 100k, 500k, 1M, 2M. Included are 16 and 32mm single and dual gang rotary and slider pots. Quantity per pack is 25. At this price they are a must for the tool box as spares!

Only $20.00 Per Pack

Hurry - Stock is Limited. Not Available from Altronic Resellers at these Prices!

High Power Sirens

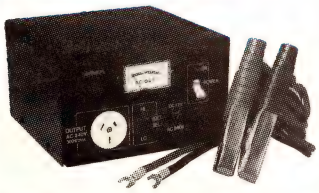


Features strong and durable construction, making it ideal for car, boat or home installation. Includes a handy bracket for wall mounting etc. Extremely loud 120dB output. Requires 12V DC at 300mA. Dimensions 100mm Ø by 125mm Long.

Massive 120dB Output!

S 6130 $29.95

300 Watt Inverter



This nifty inverter converts 12 Volts DC to 240 Volts AC. Includes an on/off switch and a light & heavy load switch with metered output. Works well with most electrical equipment.

M 8120 NORMALLY $249.00

This Month Only $229.00

Mini XLR Connectors

NEW

Just arrived into stock is a new range of miniature 3 pin XLR connectors. The outside diameter of the male is only 10mm. Ideal for audio projects where a small and reliable connection is required.

Ideal for Those Miniature Audio Projects!

P 0890	Inline Female	$3.15
P 0892	Inline Male	$3.15
P 0891	Chassis Mount Male	$3.90
P 0893	Chassis Mount Female	$4.15

De-Soldering Braid

Quality "Soder Wick" Brand. Available in 6 sizes. Ideal for all those de-soldering jobs.

T 1210	0.76mm White	$4.50
T 1212	1.5mm Yellow	$4.50
T 1214	2.0mm Green	$4.50
T 1216	2.75mm Blue	$5.25
T 1218	3.7mm Brown	$5.75
T 1220	5.3mm Red	$6.25

Buy the Set for Only $26

PECC Speaker Bargains

These speakers feature Poly Emulsion Coated Cone (PECC) and barium ferrite magnets offer quite remarkable performance and extremely low distortion. Call ALTRONICS for full specifications.

Update those Old Hi-Fi Speakers

C 3022 6.5" PECC Normally $49.95

This Month Only $38.00

Max Input Power .....60 Watts

Freq Response.....f0 - 5 kHz

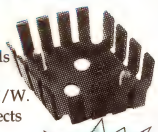
C3030 12" PECC Normally $155.00

This Month Only $135.00

Max Input Power .....160 Watts

Freq Response.....f0 - 3 kHz

Thermally TO–3 Heatsink



Includes threaded studs to secure transistors. Thermal resistance 7°C/W. Ideal for all those projects with TO-3 transistors.

H 0503 Normally $1.20

This Month Only .50¢ ea

Hurry - Only While Stocks Last!

VU Panel Meters

These quality meters are ideal for amplifier projects or replacement units. MU45 quality class 2.5.

Q 0528 Normally $21.20

This Month Only $16.95

36 Way Centronics Plug

Solder type. Bargain priced. Limited stock. Ideal for printer leads etc.

P 0770 Only $5.00

100mm Super Carbon Fibre Speakers

Fantastic for Cars, Boats, Homes etc.

These amazing little speakers will impress you and your friends. Carbon fibre is a new high tech material from which these speaker cones are made. Complimented with Barium Ferrite Magnets the results are simply amazing. 16 ohm voice coils make these units ideal for multi-speaker installations a breeze. Weather-proof design means they are fantastic for cars, boats, homes etc.

C 0643 Normally $39.95

This Month Only $25.00 ea, or $40.00 Pair

State-of-the-Art Microprocessor Remote Car Alarm

This amazing model features just about everything you could imagine! Multi-function key ring remote control will arm and disarm alarm (and activate central locking if fitted), chirp the horn, turn on the car headlights, panic and even open the boot (if actuator fitted). One remote can control two alarms (in two cars). Other features include starter inhibit, valet mode, central locking interface, flashes car indicators when tripped, auto reset, user programmable options plus much more.

Phone Order Now to Reserve Yours! 30 Only

S 5230 Normally $249.00, **This Month Only $199**

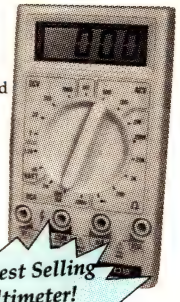
ALTRONIC COMPONENTS

PHONE ORDER - PERTH (09) 328 1599

ALTRONIC COMPONENTS • Jet Express • AUSTRALIA WIDE

ALTRONIC COMPONENTS

17 Range Economy 3.5 Digit Digital Multimeter



Our most popular multimeter. With quality and features you would expect only on expensive meters the Q 1056 represents excellent value for money.

Specifications:

DC Voltage Ranges: 2V, 20V, 200V, 2000V
AC Voltage Ranges: 200V, 500V
DC Current Ranges: 200mA, 20mA, 2mA, 10A
Resistance Ranges: .....200 Ohm, 2k Ohm, 20k Ohm, 200k Ohm, 2M Ohm
Battery Test Ranges:.....1.5V, 9V Loaded
Battery Test Current:.....1.5V 100mA, 9V 6mA

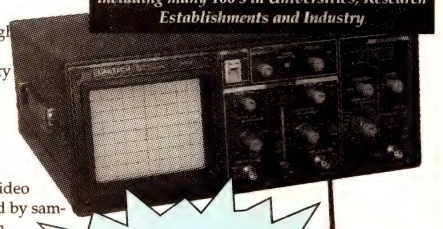
Q 1056 Normally $59.95

This Month Only $39.95

Our Best Selling Multimeter! Save a Massive $20

Famous Labtech 20MHz Dual Trace Oscilloscope

Now Over 2000 in service throughout Australia including many 100's in Universities, Research Establishments and Industry



This model is a dual trace, 20MHz oscilloscope with a high brightness CRT. The vertical amplifiers have high sensitivity of 5mV/div and a frequency characteristic response with a smooth roll off exceeding 20MHz. The TV sync. signal operator circuit is provided to ensure stable observation of video signals. Triggering is obtained by sampling the AC power waveform, external waveform or internally generated trigger. Requires Q 0175 CRO probes.

Q 0156 CRO **$699**

Q 0175 CRO Probes to Suit **$49.95 ea**

Buy Before the Price Rise. Last Month at this Price! We Regret that due to devaluation of A$ the next Shipment Cost will Increased to $750

1GHz Frequency Counter

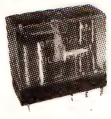
This multiple function 10Hz to 1GHz counter features an 8 digit LED readout, small size, light weight, and a highly stabilised crystal oscillator for accurate measurement.

Q 1535 Normally $499.00

This Month Only $449.00

Save $$$ Over Equivalent Commercial Units

PCB Mount Relays



DPDT. 6V Coil Heavy duty 5 amp contacts make them ideal for a myriad of applications. Only while stocks last.

S 4185 Normally $9.95

This Month Only $4.95

Cradle Relays

These high quality relays can be used with or without cradle socket. Limited stock. Buy now and save! Not available from Altronic Resellers.

Relays Normally $9.95, **This Month Only $4.95**

S 4220 12V DPDT Relay
S 4225 24V DPDT Relay
S 4235 24V 4PDT Relay

S 4242 Cradle to Suit S 4235 **Only $1.5**

Digital Voltmeter

This well designed LCD module will take care of most of your requirements of digital voltmeter displays. Voltage range and decimal place options are easily configured by PCB links. Small, compact, reliable and comes complete with plastic surround to give a professional finish. Call Altronics for full specifications.

Specifications:

Digits: .....3.5, 13mm Height
Ranges:.....200mV, 2V, 20V, 200V, 1000V DC
Input Impedance:.....10MΩ
Power Supply: .....9V DC
Accuracy:.....+/-0.5% (2 digit)

Q 0560 $39.95

Micron Series II Soldering Station

The *MICRON* Series 2 soldering station employs electronic switch mode circuitry in lieu of a mains transformer. Excellent for all general purpose and production soldering.

Features:

- High insulation ceramic heating element in both rapid heat-up and instant recovery
- Heater insulation of over 100MΩ
- A zero voltage circuit ensures no high voltage spikes or magnetic field are present at the tip to damage sensitive components
- Continuous temperature adjustable from 250° to 430° C (480° to 800° F) • Grounded power cord

Selecting the desired operating temperature is as simple as turning a knob.

Simply choose the operating temperature required for the job and adjust the control to the appropriate setting. With its huge temperature range from 250° to 430° C this iron is suitable for most applications, from delicate double sided PCB's through to typical day to day jobs.

T 2443 $129.95

NEW

Just Arrived! A Soldering Station for Under $130

ALTRONICS

174 Roe St. Perth W.A. 6000
Phone (09) 328 1599, **Fax** (09) 328 4459
MAIL ORDERS C/- P.O. Box 8350
Stirling Street, PERTH W.A. 6849

STANDARD DELIVERY & PACKING CHARGE $3.50 to 500gms, $5.50 500gms -1 kg, $8 1kg-5kg **AUSTRALIA WIDE**-We process your order the day received and despatch via. Australia Post. Allow approx 9 days from day you post order to when you receive goods.

OVERNIGHT JETSERVICE Up to 3kg is $10.00, 3kg to 5kg is $23.00—We try to process your order the day received and despatch via. **Overnight Jetservice Courier** for delivery next day Country areas please allow additional 24-48 hours.

HEAVY HEAVY SERVICE-All orders of 10kgs or more must travel Express Road—Please allow 7 days for delivery. $12.00 to 10kgs. $15.00 over 10kgs.

INSURANCE-As with virtually every other Australian supplier, we send goods at consignee's risk. Should you require comprehensive insurance cover against loss or damage please add $1.00 per $100 of order value (minimum charge $1). When phone ordering please request "Insurance".

TOLL FREE PHONE ORDER-Bankcard, Visa, Mastercard Holders can phone order toll free up to 4pm Eastern Standard Time. Remember with our Overnight Jetservice we deliver next day.

ALTRONICS RESELLERS Chances are there is an Altronic Reseller right near you—check this list or phone us for details of the nearest dealer. Blue Ribbon Dealers are highlighted with a ● These dealers generally carry a comprehensive range of Altronic products and kits or will order any required item for you.

WA - COUNTRY

ALBANY	BP Electronics ●	(098) 412681
	Micro Electronics	(098) 412077
BUNBURY	Micro Electronics	(097) 216222
ESPERANCE	Esperance Comm.	(090) 713344
MANDURAH	Forum Electronics	(09) 5813466
PORT HEDLAND	Ivan Tomek Electronics	(091) 732531
ROCKINGHAM	TV Joe's	(09) 5271806

NT

ALICE SPRINGS	Farmer Electronics	(089) 522388
DARWIN	Ventronics	(089) 853 622

VIC - CITY

	All Electronic Comp	(03) 6623506
	TECS ●	(03) 6706474
BORONIA	Ray Cross Electronics ●	(03) 7622422
CHELTENHAM	Talking Electronics	(03) 5842386
COLLINGWOOD	Truscott Electronics ●	(03) 4198208
CROYDON	Truscott Electronics ●	(03) 7233860
FOOTSCRAY	G.B. Telespares	(03) 3266035
PRESTON	Preston Electronics ●	(03) 4840191

VIC - COUNTRY

BAIRNSDALE	LH & LM Crawford	(051) 525677
BALLARAT	Ballarat Electronics	(053) 311947
BENDIGO	Sumner Electronics	(054) 431977
MILDURA	Pullman Auto	(050) 232882
	Truscott Electronics ●	(050) 238138
SHEPPARTON	Andrew Guyatt Elect.	(058) 219497
WARRNAMBOOL	Koroit Electronics	(055) 627 417

QLD - CITY

	Delsound PL●	(07) 8396155
	E.C.Q.	(07) 2541153
NEWSTEAD	B.A.S. Audiotronics	(07) 8447566
WEST END	David Hall Elect.●	(07) 8082777
WOODRIDGE		

QLD - COUNTRY

GLADSTONE	Gladstone Elect. Services	(079) 724459
	Electronic Enterprises	(079) 726660
MAROOCHYDORE	Mals Electronics ●	(074) 436119
TOWNSVILLE	Super Solex ●	(077) 724466

SA - CITY

	Force Electronics ●	(08) 2125505
BRIGHTON	Force Electronics ●	(08) 3770512
FINDON	Force Electronics ●	(08) 3471188
HOLDEN HILL	Force Electronics ●	(08) 2617088
LONSDALE	Force Electronics ●	(08) 3260901
SALISBURY	Force Electronics ●	(08) 2830755

SA - COUNTRY

WHYALLA	Eyre Electronics	(086) 454764

TAS

HOBART	George Harvey ●	(002) 342233
LAUNCESTON	George Harvey ●	(003) 316533

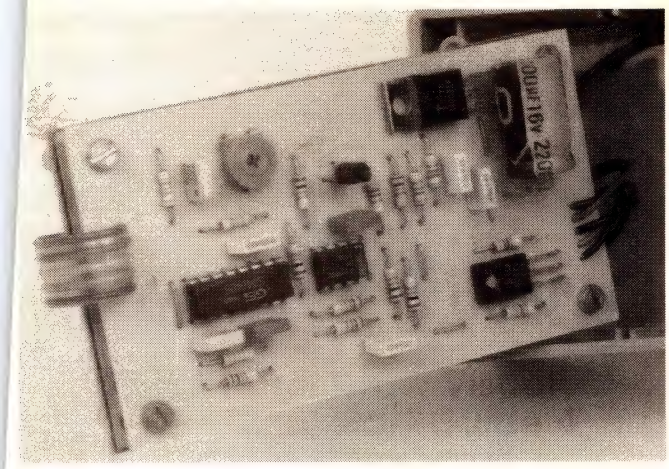
NSW - CITY

	A-One Electronics	(02) 2674819
	David Reid Elect. ●	(02) 2671385
SMITHFIELD	Chantronics	(02) 6097218

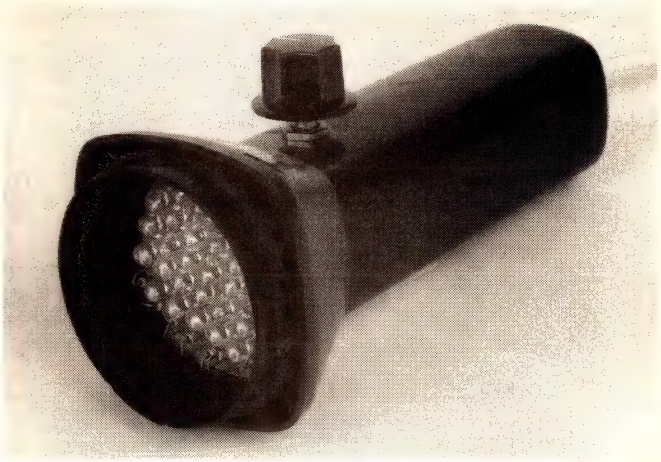
NSW - COUNTRY

COFFS HARBOUR	Coffs Habour Elect.	(066) 525684
NEWCASTLE	Novocastrian Elect.Supplies	(049) 621358
WARNERS BAY	Vilec Distributors	(049) 566792
WINDSOR	M & E Elect. and Comm.	(045) 775935
WOLLONGONG	Newtek Electronics ●	(042) 271620
	Vimcom Electronics	(042) 284400
WOY WOY	Alphatran Electronics	(043) 434919

PHONE ORDER - FREECALL 008 999 007



This close-up view shows the completed VCO board, after it has been stacked with the counter board. The trimpot (VR2) allows the counter circuit to be calibrated, so that it shows the correct speed of the rotating object in RPM.



We mounted the LED array & the speed control pot (VR1) inside an old torch case but a suitable piece of conduit could also be used. The various connections to the control module are run via a 5-way cable fitted with a DIN plug.

brief period. When pin 12 goes low again, pin 15 of IC2f goes high and resets IC3 to 000. IC3 then begins counting the pulses applied to its clock input from the VCO as soon as the MR signal goes low again.

Power for the circuit is derived from a 12V DC plugpack supply. This drives a 7809 3-terminal regulator to derive a 9V supply rail, while a 2200µF capacitor provides supply line decoupling. Diode D1 protects the circuit against damage if the supply is connected with reverse polarity.

Because the high-brightness LEDs and the LED displays draw a fair amount of current, the plugpack should be rated at 500mA. A 300mA plugpack will work but LED brightness will be reduced.

Construction

The LED Stroboscope is built on three PC boards: a VCO board (code 04112931), a counter board (code 04112932) and a LED array board (code 04112933). The first two boards measure 100 x 55mm and are mounted back-to-back on 5mm spacers inside a plastic case. The LED array board is circular in shape and is mounted separately, along with the speed control pot, inside the torch body or in some other suitable tube (eg, plastic conduit). It is connected back to the control circuitry via a 1-metre cable fitted a 5-pin DIN plug.

Brief Specifications

Range ..... 0-19,000 RPM
Light Source ..... High-brightness LEDs
Power Supply .... 12V DC @ 500mA
Readout ..... 3-digit LED display
Resolution ..... 100 RPM
Accuracy ..... 1% ± 100 RPM

Fig.2 shows how the parts are installed on the boards. The parts can be mounted in any order, although it's always best to mount the smaller parts first. Don't forget the small wire link immediately beneath DISP 3 and make sure that all polarised parts are correctly oriented. These include the transistors, diodes, ICs and electrolytic capacitors.

The six transistors on the counter board all face in the same direction but be sure to use the correct type at each location. Q2, Q4 & Q6 are all BC557 PNP types, while Q3, Q5 & Q7 are BC337 NPN types. It's easy to get these transistors mixed up so take care when installing them on the board.

Note that each transistor should be pushed down onto the board as far as it will comfortably go before solder-

RESISTOR COLOUR CODES

❑	No.	Value	4-Band Code (1%)	5-Band Code (1%)
❑	1	2.7MΩ	red violet green brown	red violet black yellow brown
❑	2	470kΩ	yellow violet yellow brown	yellow violet black orange brown
❑	4	100kΩ	brown black yellow brown	brown black black orange brown
❑	2	47kΩ	yellow violet orange brown	yellow violet black red brown
❑	7	10kΩ	brown black orange brown	brown black black red brown
❑	1	4.7kΩ	yellow violet red brown	yellow violet black brown brown
❑	1	3.3kΩ	orange orange red brown	orange orange black brown brown
❑	3	1kΩ	brown black red brown	brown black black brown brown
❑	1	390Ω	orange white brown brown	orange white black black brown
❑	7	270Ω	red violet brown brown	red violet black black brown
❑	8	47Ω	yellow violet black brown	yellow violet black gold brown

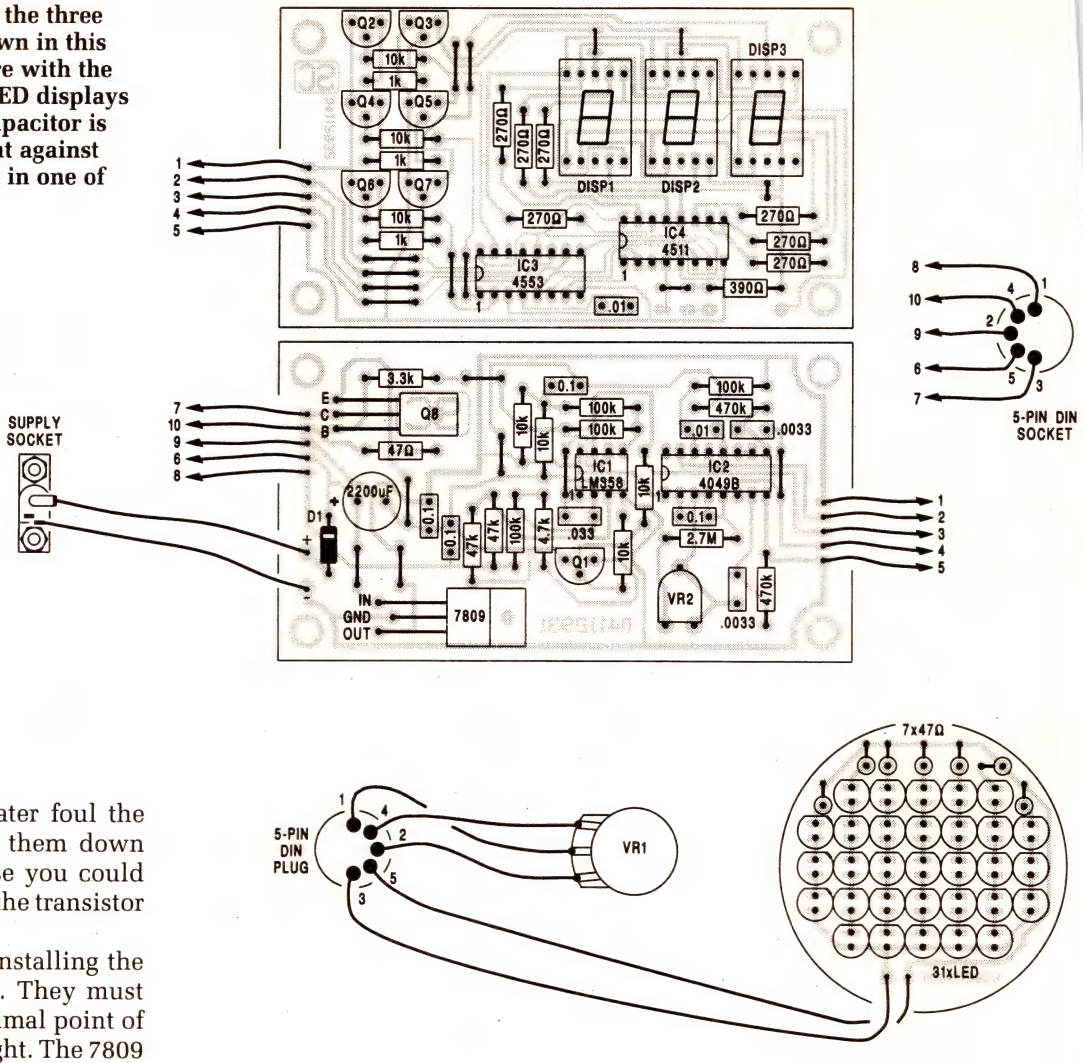


Fig.2: install the parts on the three PC boards exactly as shown in this wiring diagram. Take care with the orientation of the three LED displays & note that the 2200µF capacitor is mounted with its body flat against the VCO board, as shown in one of the photographs.

ing, so that it doesn't later foul the front panel. Don't force them down too far though, otherwise you could fracture the leads inside the transistor bodies.

Take care also when installing the 7-segment LED displays. They must be oriented with the decimal point of each display at bottom right. The 7809 regulator is mounted flat against the VCO board by bending its leads at right angles so that they mate with the mounting holes. It is then secured to the board using a screw and nut.

The LED array board is easy to assemble. Just make sure that the LEDs are all correctly oriented. If any LED does go in the wrong way, then all the LEDs in that row will fail to light because that LED will be reversed biased.

Once all the parts are in, the VCO and counter boards can be placed end-to-end and their 1-5 terminals connected together via a short length of 5-way rainbow cable. The 5-pin DIN socket and the power supply socket are now mounted at either end of the

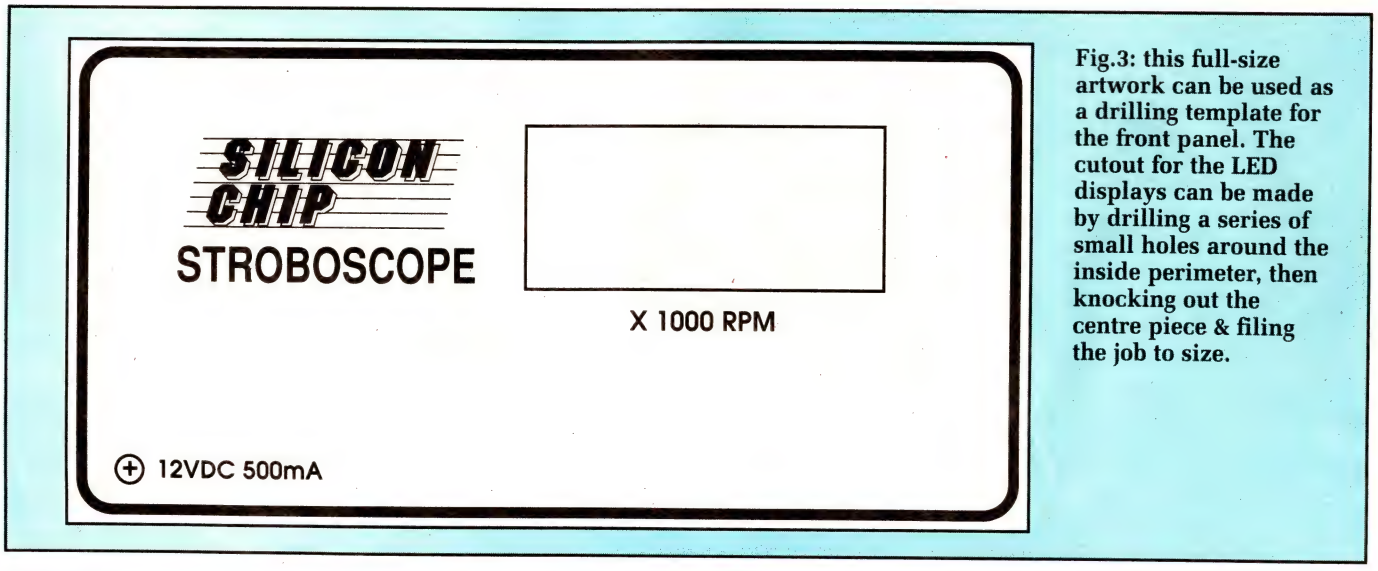
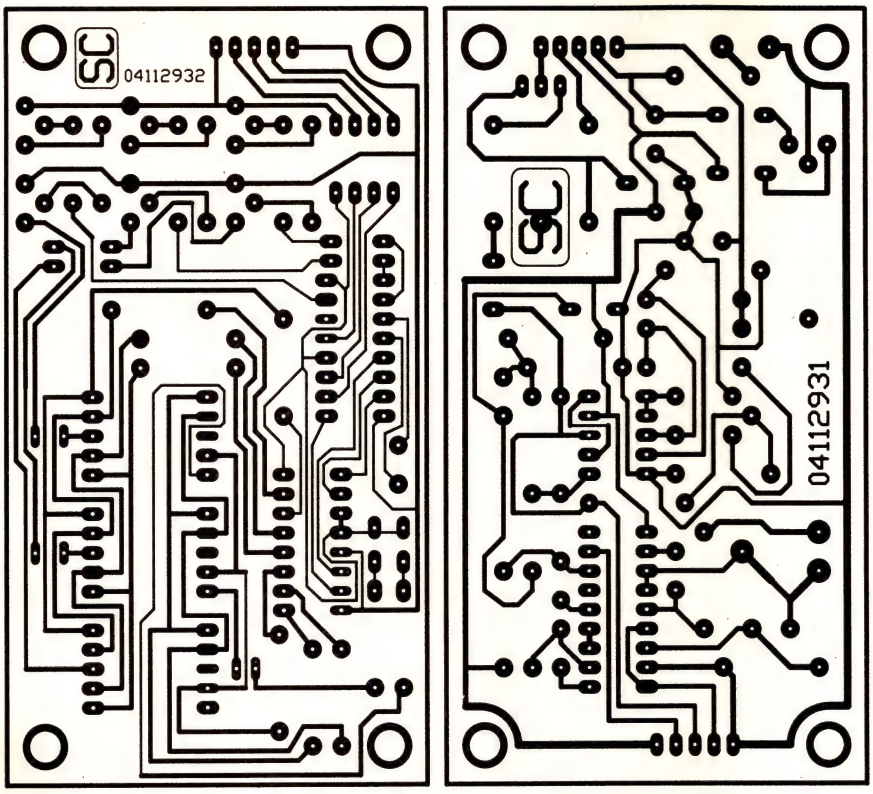


Fig.3: this full-size artwork can be used as a drilling template for the front panel. The cutout for the LED displays can be made by drilling a series of small holes around the inside perimeter, then knocking out the centre piece & filing the job to size.



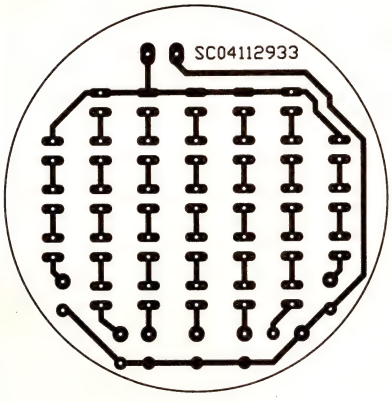


Fig.4: check your PC boards against these full-size etching patterns before installing any of the parts. In particular, check that there are no broken tracks or shorts between tracks due to incorrect etching.

case and the remaining wiring installed – see Fig.2. Note that these two sockets must be positioned towards the bottom of the case, to provide sufficient clearance for the PC boards.

At this stage, it is a good idea to go back over the board assemblies and check for wiring errors. When you are satisfied that everything is correct, the two boards can be stacked together using 5mm spacers and 10mm-long screws inserted from the VCO board side. The assembly is then secured by fitting a 10mm tapped spacer to each mounting screw – see photos.

Connecting the LED array

A 1-metre length of 5-way cable is used to connect the LED array board and pot VR1 to the control circuit (we actually used 3-pair telephone cable, with one wire left unused). This cable is fitted with a 5-pin DIN plug at one end, while the other end passes through a hole drilled in one end of the torch before connecting to VR1 and the LED array.

The pot is mounted by drilling a hole through the side of the torch case, while the LED array board can be secured using silicone sealant. Be sure to remove the switch contacts from inside the torch to prevent it from shorting against any of the circuitry.

The 10kΩ pot we used was a 16mm type which was easily fitted in the torch case. If you have a bigger housing than the one we used, you could use a standard size pot. Note that different supply voltages are used for the pot and the LED array. The pot supply comes from the 9V regulator, while the LED array is supplied from the 12V plugpack via D1.

Test & calibration

To test the unit, apply power and check that the three 7-segment displays light up. At this stage, the readout won't be calibrated but you should see recognisable numbers appear and the readout should vary as you vary the control pot (VR1).

The high-brightness LEDs should also begin flashing as soon as power is applied, depending on the setting of VR1. Check that the flash rate can be varied with VR1 (note: for higher settings of VR1, the flash rate is so fast that the LEDs appear to be continuously lit).

A word of warning here. If you suffer from migraine headaches or epilepsy, then stay well away from this project. The bright flashes of light produced by the strobe can quickly trigger an attack.

Assuming everything works correctly, the unit can now be calibrated. You will need a digital frequency meter for this job. The first step is to set VR1 so that the VCO frequency at pin 7 of IC1b is 200Hz (as measured on the DFM). This done, VR2 is adjusted until the stroboscope display reads 12.0 (corresponding to 12,000 RPM).

Alternatively, you can calibrate the unit against a machine that rotates at a known speed. To do this, set VR1 to the lowest setting at which the reference line appears stationary and adjust trimpot VR2 for the correct reading on the display.

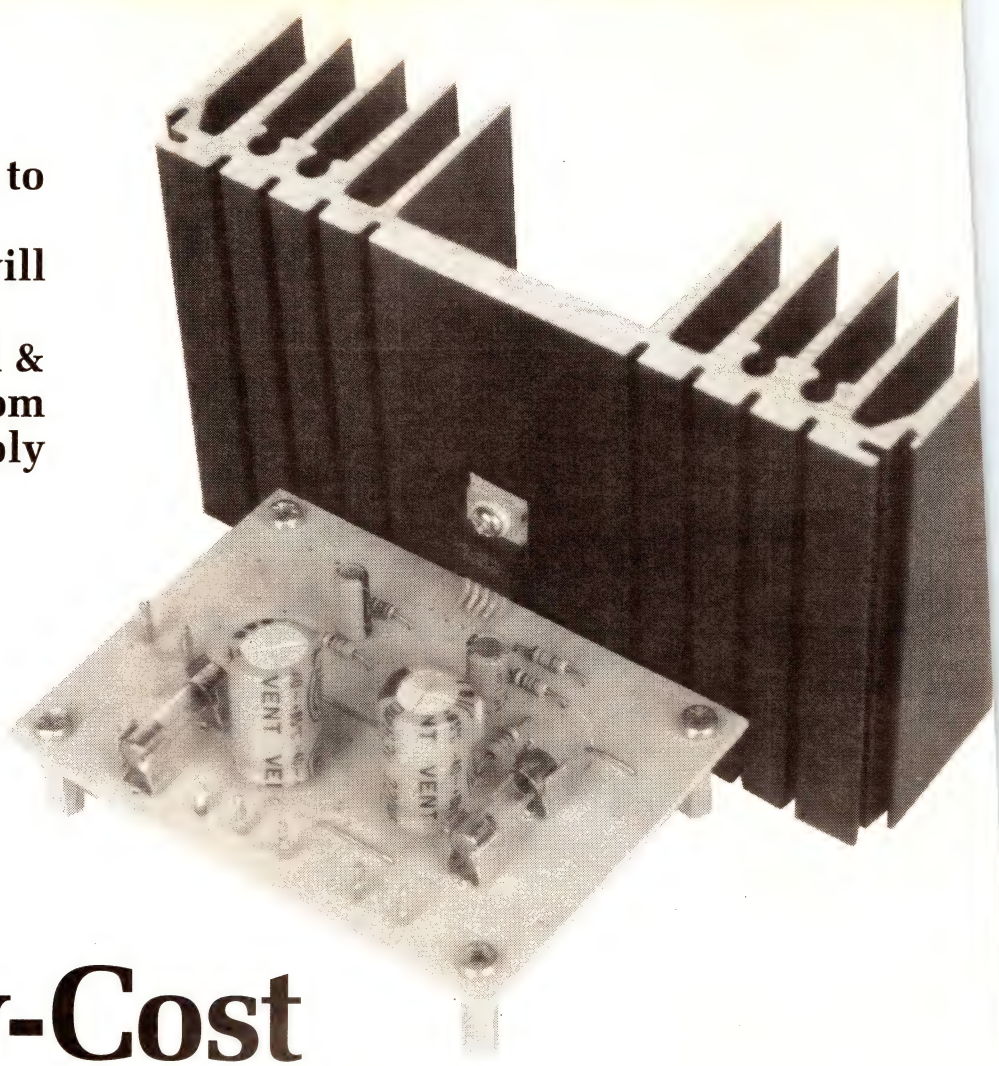
Final assembly

All that remains now is to install the control module inside the plastic case. The first step is to attach the front-panel label to the lid and use it as a drilling template for the board mounting screws. This done, drill a series of small holes around the inside perimeter of the display cutout area. The centre piece can then be knocked out and the job filed to a smooth finish so that the red Perspex® window is a tight fit.

It's now simply a matter of securing the control module to the lid using four 5mm-long machine screws. If necessary, the Perspex window can be glued into position using epoxy resin but don't use too much as this would spoil the appearance of the unit. **SC**

Looking for a low-cost audio power module that's easy to assemble? This compact module will deliver 25W RMS into an 8-ohm load & can be powered from single or dual supply rails.

By DARREN YATES



A Low-Cost 25W Amplifier Module

AS POWER amplifier modules go, this unit may not rank at the top for raw power but you'll be hard-pressed to find a simpler or more versatile circuit. It's based on a single IC, the LM1875T 20W audio amplifier from National Semiconductor. This IC comes in a TO-220 package and, combined with a handful of other parts and a suitable power supply, delivers 25W RMS into 8 ohms and 20W RMS into 4 ohms.

What's more, the specifications are quite impressive for such a bare-bones circuit. With a signal-to-noise (S/N) ratio of 110dB and a distortion figure of just 0.025% for 1kHz at 20W, it could well be used as the basis for a hifi stereo amplifier. The frequency response extends from 14Hz to beyond 100kHz when measured at 1W RMS.

The module is also easy to construct and no setting-up adjustments are necessary. And, as mentioned in the introduction, it can be powered from either single or dual supply rails (you can build either version on the same board). The supply voltage can range from 20V to 50V for a single supply rail, or from ±10V to ±25V for dual supply rails.

Depending on the supply voltage, the output power ranges from 4W into 8 ohms (20V supply) to 25W into 8 ohms (50V supply).

To guard against device failure, the LM1875 includes internal short circuit protection. This protects the device if the output is shorted to ground via either an AC or a DC path. It also has current limiting to 4A to prevent damage when driving reactive loads, which makes it a highly robust module that can handle more than its share of knocks.

Because so much power has to be dissipated by such as small package, the LM1875 also has in-built thermal protection. This shuts the device down if there is excess heat build-up in the chip itself (in excess of about 175°C).

Other specifications of the device include a supply rejection figure of -94dB, an open loop gain of typically 90dB and a power bandwidth of 70kHz. If you'd like more information on the LM1875 audio amplifier, refer to the data article elsewhere in this issue.

ecause there are two possible power supply ar-gements, we're presenting two circuit diagrams – Figs.1 & 2. Both circuits have low component nts and differ only in a few minor details.

ngle supply version

ig.1 shows the circuit for the single supply version. shown, the input signal is coupled via a 1kΩ pper resistor and a 1µF capacitor to the non-invert- input of IC1 at pin 1. This input is biased to ½Vcc , half the supply rail) via the three 22kΩ resistors d the associated 10µF capacitor.

The closed loop gain of the amplifier is set to 19 by e 180kΩ and 10kΩ feedback resistors on pin 2 and llows the standard non-inverting amplifier feedback les (ie, G = 180/10 + 1 = 19). The 2.2µF capacitor and e 10kΩ resistor set the lower 3dB frequency point to Hz.

The output from the amplifier appears at pin 4 of C1 and drives the loudspeaker via a 2200µF coupling apacitor (to prevent DC from flowing in the speaker oil). Also connected to the output is a series 1Ω esistor and a 0.22µF capacitor. These components orm a Zobel network and this provides high-frequency tability when driving capacitive loads.

Power for this circuit is derived from a mains trans-ormer with a 35V secondary winding (either a single 35V winding or two 17.5V windings connected in series). The resulting AC voltage drives bridge rectifier BR1 (PW04), the output of which is then filtered with a 2200µF capacitor to give a nominal +50V DC rail. Further on-board supply decoupling is provided by a 220µF 63VW capacitor, while a 2A fuse protects against any external shorts to ground. Finally, a .01µF capacitor is connected across the power on/off switch (S1) to minimise the switch-off "thump".

Dual supply version

The dual supply version (see Fig.2) uses the same feedback and Zobel network components as the single supply version. Apart from the power supply itself, the main difference between the two circuits is the input DC biasing arrangement. Pin 1 of IC1 is connected to the 0V rail via a single 22kΩ resistor. In addition, the 2200µF output coupling capacitor is omitted, since pin 4 of IC1 normally sits within ±50mV of 0V, with no signal present.

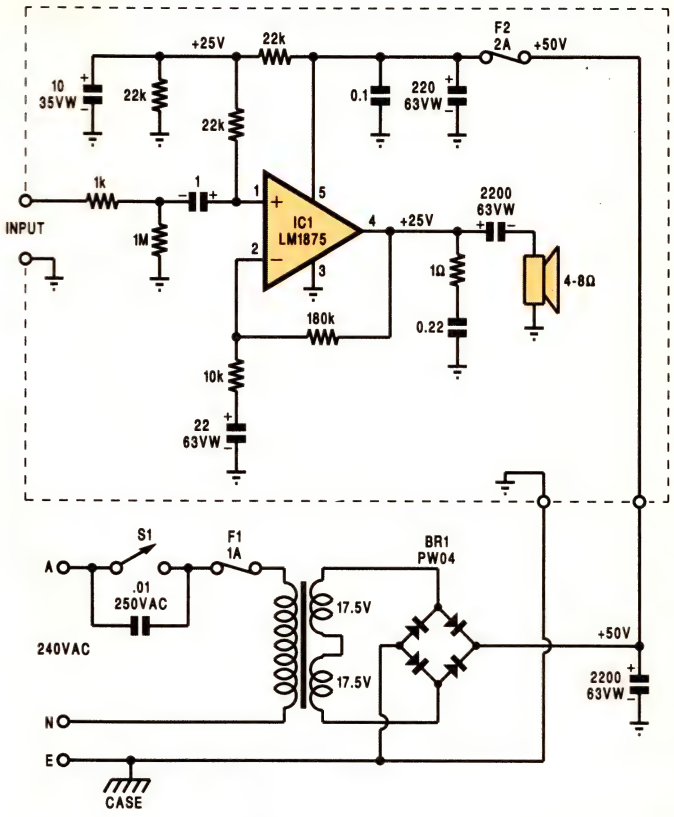
The power supply uses a mains transformer with a centre-tapped 35V secondary. The resulting outputs from bridge rectifier BR1 are filtered using two 2200µF capacitors to give nominal ±25V supply rails and these go to pins 5 and 3 of IC1 via 2A fuses.

Construction

Construction of the amplifier is quite straightforward – see Figs.3 & 4. All you have to do is follow the diagram for the version you require.

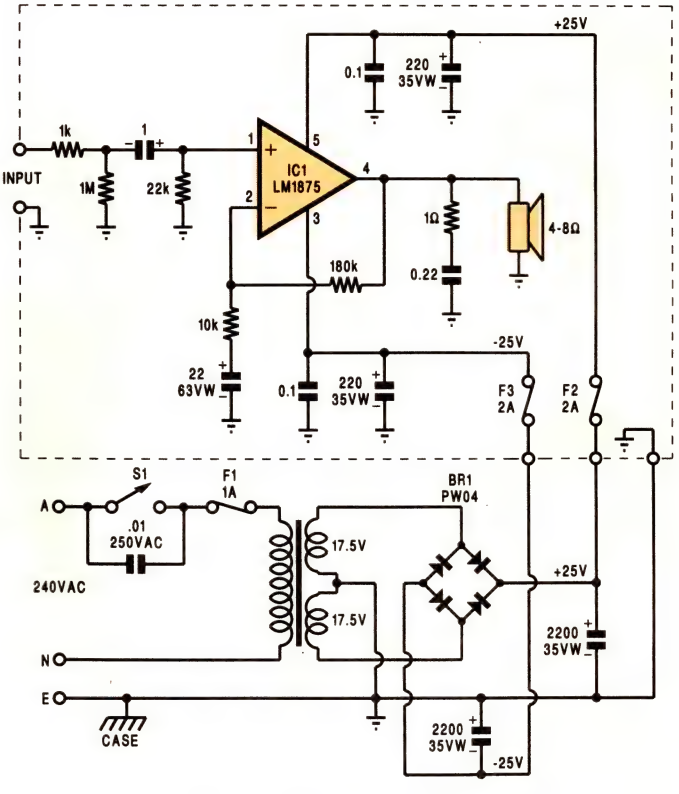
In either case, start by checking the PC board carefully for any defects by comparing it with the published pattern. This done, begin the board assembly by soldering in the wire links and by installing PC stakes at the external wiring points.

The resistors and capacitors can now be installed,



25W AUDIO POWER MODULE
SINGLE SUPPLY

Fig.1: the single supply version of the 25W Amplifier Module. IC1 drives the loudspeaker via a 2200µF capacitor.



25W AUDIO POWER MODULE
DUAL SUPPLY

Fig.2: the dual supply version of the 25W Amplifier Module.

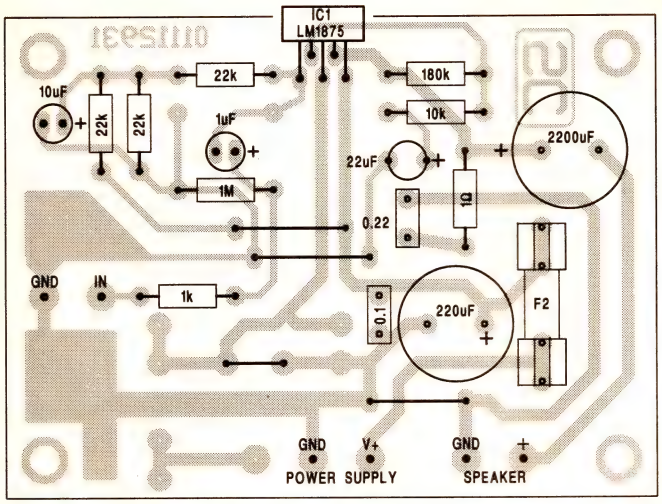


Fig.3: parts layout for the single supply version.

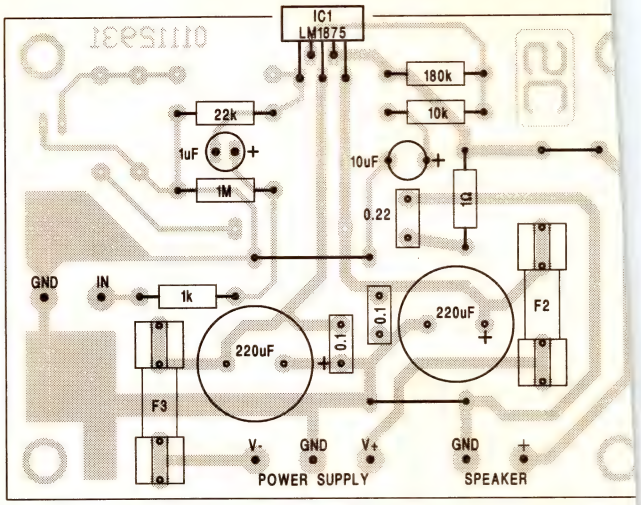


Fig.4: parts layout for the dual supply version.

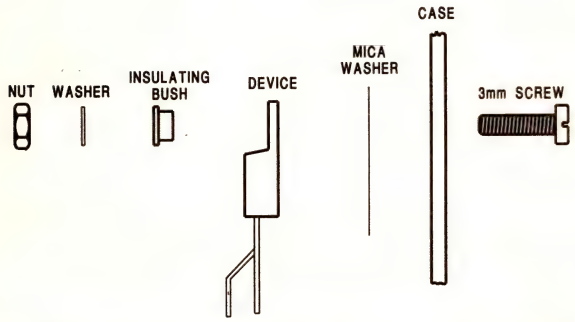
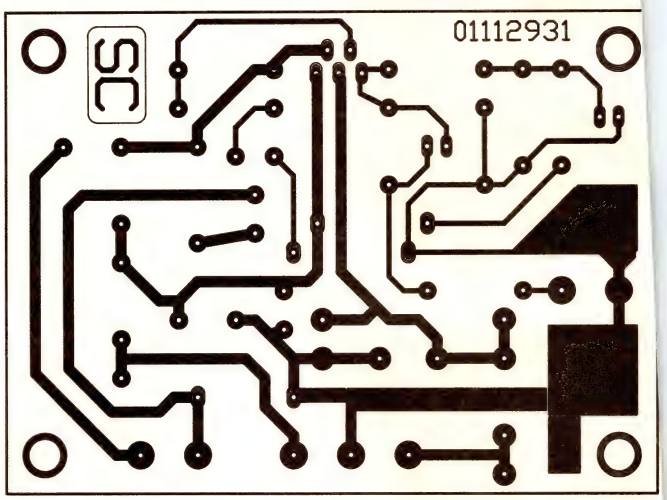
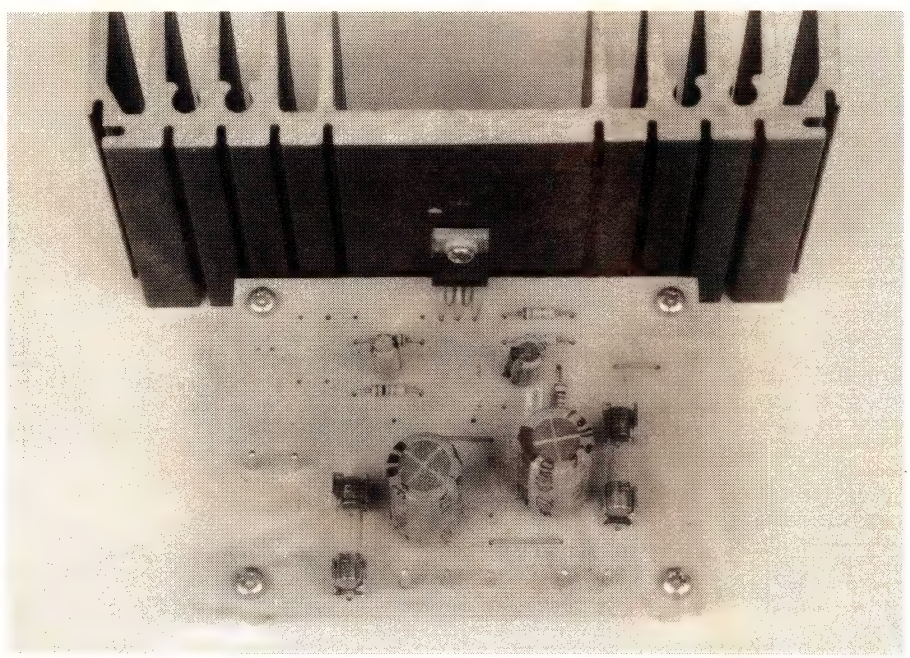


Fig.5 (above): this diagram shows how the LM1875 audio amplifier IC is insulated from the heatsink using a mica washer & insulating bush. Smear all mating surfaces with heatsink compound before bolting the assembly together, then use your DMM to confirm that the device is correctly isolated. Fig.6 at right shows the full-size PC artwork.





This is the dual supply version of the 25W Amplifier Module. Check the supply rail voltages, the quiescent current & the DC offset voltage across the output terminals before connecting a loudspeaker – see text.

followed by the fuse clips. Make sure that the electrolytic capacitors are correctly oriented, otherwise they may be destroyed when power is applied. The fuse clips must also be correctly oriented, with the retaining tabs towards the outside.

Once these parts are in, install the LM1875 and then fit 15mm spacers to the corner mounting positions of the board. The board and the heatsink can then be placed on a flat surface and the mounting hole marked out for the IC. Drill this hole to 3mm and carefully remove any metal swarf using an oversize drill to ensure a perfectly smooth surface.

The IC is now bolted to the heatsink using a TO-220 insulating kit (ie, a mica washer and insulating bush). Fig.5 shows the assembly details. Smear all mating surfaces with heatsink compound before bolting the assembly together, then use your multimeter to confirm that the metal tab of

IC is indeed electrically isolated n the heatsink.

Note that no provision has been de for the power supply compo- nts on the PC board. This has been ne deliberately to avoid potential m problems due to circulating earth rrents when using two modules in tereo amplifier. If you wish to run o modules, you should use a com- on power supply and ideally the nsformer should have a rating of out 80VA, although for most appli- tions a 60VA unit will suffice.

The transformer used to test the ototype was a 60VA unit with two 7.5V secondary windings from Dick mith Electronics (Cat. M-6676). A 0V 60VA power transformer could lso be used, although this will result n reduced power output. Do not use 30V 1A transformer as its rating will e insufficient.

Testing

Before applying power, check that ll parts are correctly located and ori- nted. This done, install the fuse(s) nd connect the power supply leads with your multimeter (switched to Amps) in series with the positive rail. Do not connect the loudspeaker or an audio input signal at this stage.

Now switch on and check that the current settles down to 50-70mA following a brief surge to charge the main filter capacitor(s). Note that you must have the heatsink fitted, otherwise the thermal overload protection circuit may cut in and switch the device off. Check the supply rail voltages – they should be within 10% of the values shown on the circuit.

If the quiescent current is correct, check the DC offset voltage across the loudspeaker terminals. It should be less than ±50mV. If this checks out, the loudspeaker can be connected (switch off first) and an audio input signal applied for final testing. SC

PARTS LIST

Single Supply Version

1 PC board, code 01112931, 87 x 64mm
6 PC stakes
4 15mm x 3mm tapped spacers
1 TO-220 heatsink mounting kit (ie, mica washer & insulating bush)
4 15mm x 3mm machine screws
2 2AG fuse clips
1 1 amp 2AG fuse
1 heatsink (Altronics Cat.H-0580 or equivalent).

Semiconductors
1 LM1875T 20W audio amplifier (IC1)

Capacitors
1 2200µF 35VW electrolytic
1 220µF 63VW electrolytic
1 22µF 63VW electrolytic
1 10µF 35VW electrolytic
1 1µF 63VW electrolytic
1 0.22µF 63VW MKT polyester
1 0.1µF 63VW MKT polyester

Resistors (0.25W, 1%)
1 1MΩ 1 10kΩ
1 180kΩ 1 1kΩ
3 22kΩ 1 1Ω

Power supply parts
1 35V 60VA power transformer (DSE Cat. M6676 or equivalent - see text)
1 PW04 bridge rectifier (BR1)
1 mains switch (S1)
1 2200µF 63VW electrolytic capacitor
1 .01µF 250VAC polyester capacitor

Miscellaneous
Tinned copper wire, solder, screws, nuts & washers.

PARTS LIST

Dual Supply Version

1 PC board, code 01112931, 87 x 64mm
7 PC stakes
4 15mm x 3mm tapped spacers
1 TO-220 heatsink mounting kit (ie, mica washer & insulating bush)
4 15mm x 3mm machine screws
4 2AG fuse clips
2 1 amp 2AG fuse
1 heatsink (Altronics Cat.H-0580 or equivalent).

Semiconductors
1 LM1875T 20W audio amplifier (IC1)

Capacitors
2 220µF 63VW electrolytic
1 22µF 63VW electrolytic
1 1µF 63VW electrolytic
1 0.22µF 63VW MKT polyester
2 0.1µF 63VW MKT polyester

Resistors (0.25W, 1%)
1 1MΩ 1 10kΩ
1 180kΩ 1 1kΩ
1 22kΩ 1 1Ω

Power supply parts
1 35V centre-tapped 60VA power transformer (DSE Cat. M6676 or equivalent - see text)
1 PW04 bridge rectifier (BR1)
1 mains switch (S1)
2 2200µF 63VW electrolytic capacitors
1 .01µF 250VAC polyester capacitor

Miscellaneous
Tinned copper wire, solder, screws, nuts & washers.

RESISTOR COLOUR CODES

❑	No.	Value	4-Band Code (1%)	5-Band Code (1%)
❑	1	1MΩ	brown black green brown	brown black black yellow brown
❑	1	180kΩ	brown grey yellow brown	brown grey black orange brown
❑	3	22kΩ	red red orange brown	red red black red brown
❑	1	10kΩ	brown black orange brown	brown black black red brown
❑	1	1kΩ	brown black red brown	brown black black brown brown
❑	1	1Ω	brown black gold gold	brown black black silver brown

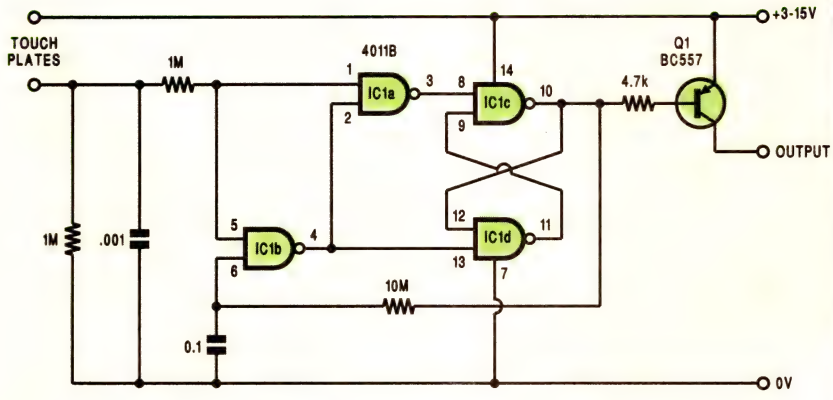
CIRCUIT NOTEBOOK

Interesting circuit ideas which we have checked but not built and tested. Contributions from readers are welcome and will be paid for at standard rates.

Single chip touch switch

This touch switch circuit provides on/off operation from a single touch pad and draws negligible current while in standby.

The circuit uses a single 4011 quad NAND gate package with IC1c & IC1d connected as an RS flipflop. The other two gates are connected with a time-constant at pin 6, arranged so that each time the touch plate is touched to pull pin 1 high, the RS flipflop changes state. Pin 10 drives transistor Q1 which can be used to control an external circuit.



A word of warning: don't leave your fingers on the touch plates for more than a second, otherwise the circuit will oscillate at a high frequency and the result will be indeterminate.

Matthew Inman,
Beacon Hill, NSW. ($15)

240V motor speed control

This circuit was developed to control a universal (brush-type) motor for a home-made coil winding machine. In this particular application, there were two prime requirements: (1) motor speed control over a wide range of speeds and loads; and (2) a capability of counting shaft revolutions (ie, coil turns). These and other requirements are met by the circuit shown.

Among the features of this circuit are:

(1) A constant speed characteristic from very low speeds to the maximum speed of the motor over the full load torque range of the motor.

(2) Symmetrical full-wave phase control to maintain maximum load performance of the motor while at the same time minimising motor brush wear (compared to half-wave speed controllers). It also ensures zero DC in the mains leads which otherwise might upset electricity authorities and lead to excessive corrosion in earthing conductors.

(3) Optical speed sensing plus an opto-coupled Triac output stage for maximum electrical isolation between the speed control circuit and the motor.

(4) Soft-start/stop characteristics to prevent jerky motor starts and sudden stops.

Speed sensing is accomplished by using a segmented disc and an optical sensor to detect the rotation of the disc. The disc was made by drawing a circle with 32 alternate black and white sectors on paper with the aid of a CAD program. The circle was cut out and glued to a plastic disc which, in turn, was mounted on a shaft driven by the motor.

The sensor consists of an infrared transmitting diode (D1) and a complementary receiving diode (D2). The diodes are mounted in holes drilled in an opaque plastic block in such a way as to prevent the direct passage of infrared radiation between them. The block was mounted adjacent to the rotating disc so that radiation from the transmitting diode was reflected from the disc to the receiving diode. As the disc rotates, it modulates the reflected radiation at the rate of 16 pulses per disc revolution.

Diode D2 converts the reflected radiation to electrical pulses which are amplified and buffered by bootstrapped emitter follower stage Q1. These pulses are applied to the clock input of IC1, a 4060 CMOS counter. Normally, the input stage of this device is used as a self-oscillating clock generator but in this case, it is used to further amplify the signal from D2 and improve noise immunity.

IC1 divides the input pulse rate to produce one output pulse at pin 7 for every 16 input pulses (ie, one pulse per shaft revolution). The resulting output pulses are then fed to an external counter/display (not shown) for counting shaft revolutions.

The output from pin 9 of IC1 is a squared-up version of the input pulses and is applied to the "trigger" input of IC4. This IC produces an output pulse of constant width (adjustable by VR1) for each input pulse. The output pulses (from pin 3) are then integrated by an RC network to produce a DC voltage proportional to the shaft speed. The input pulse rate of 16 per shaft revolution is fast enough to permit a relatively short time constant in the integrator components without too much ripple in the integrated output voltage. This results in a reasonably fast response for stable speed control at practical shaft speeds.

IC3b compares the integrated DC voltage with an adjustable DC voltage from speed control VR2. At low shaft speeds, the voltage at pin 8 of IC3b will be less than the voltage at pin 9. This will cause the output of IC3b to

high, thus turning on Q2. The resting current through the LED section of opto-coupler OPT1 will turn the Triac-driver section of OPT1, which thus turns on Triac 1 to power the motor (M).

As the shaft speed rises, the voltage level at pin 8 of IC3b will rise. If this voltage tries to rise above the voltage level at pin 9, the output of IC3b will go low, turning off Q2, OPT1 and Triac 1. As a result, the circuit will try to maintain a constant shaft speed at which the input voltages at pins 8 and 9 of IC3b are equal.

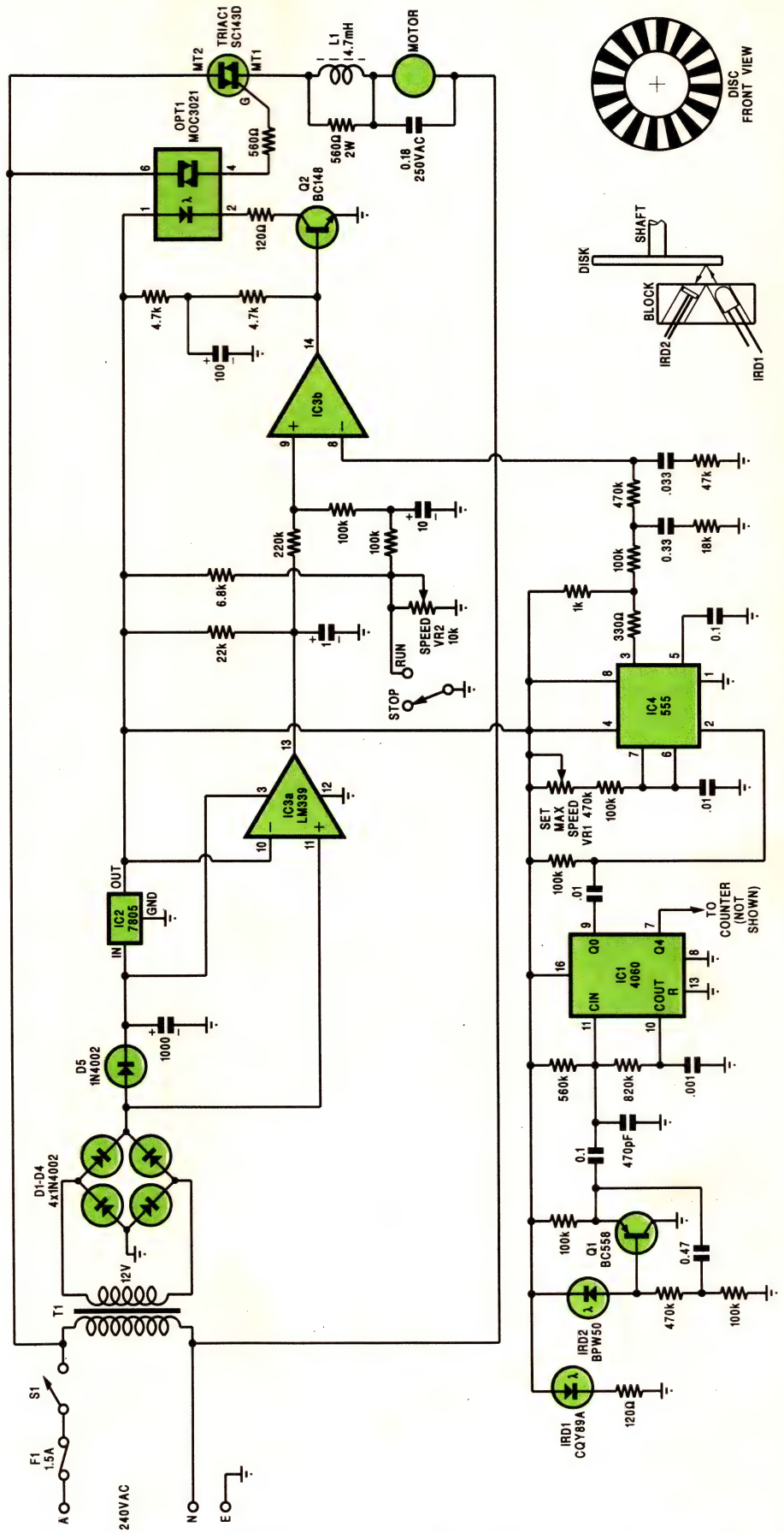
This is not the whole story, however. The input voltage at pin 9 of IC3b is modulated by a 100Hz sawtooth waveform generated by IC3a. This waveform is synchronised to the mains positive and negative half cycles. As the shaft speed approaches the value set by VR2, the voltage level at pin 8 of IC3b intersects the sawtooth waveform applied to pin 9. This results in a pulsed output from IC3b.

The phase of this pulsed output (relative to the mains waveform) varies with the voltage at pin 8 relative to the voltage at pin 9. If the motor tries to slow down, the output of IC3b will go high earlier in each half cycle, thus causing Triac 1 to conduct for a greater proportion of each half-cycle and thereby driving the motor harder. Conversely, if the motor should try to speed up, the reverse will apply and Triac 1 will apply less power to the motor.

Inductor L1, its parallel 560Ω resistor and the 0.18µF capacitor across the motor form a filter to minimise RFI (radio frequency interference) and reduce the voltage spikes generated by the motor. The inductor was wound with as many turns of 0.3mm enamelled wire as would fit on a 25mm iron dust toroid. The inductance was measured as approximately 4.7mH. This filter proved effective in reducing motor-induced voltage spikes that otherwise might harm Triac 1. Note that the filter values chosen might need to be altered for different motor sizes, although they do not appear to be critical.

Finally, note that some parts of this circuit (ie, around the filter, Triac, optocoupler and motor) operate at potentially lethal mains voltages, so exercise extreme care when working on it.

H. Nacinovich,
Gulgong, NSW. ($50)



The circuit of the motor speed controller. Speed sensing is accomplished by using a segmented disc & an optical sensor to detect the rotation of the disc.

A-ONE A-ONE A-ONE A-ONE A-O

AUSTRALIA'S LARGEST RANGE OF PRE BUILT MODULES

REGULATED POWER SUPPLIES

ITEM #	DESCRIPTION	PRICE
S0001	0-50V 3a Precision PSU with short CKT break & over load protector	49.00
S0002	0-15V 5A Regulated DC Power Supply Unit	45.00
S0003	0-25V 10A Professional High Efficiency Regulated Power Supply Unit	97.00
S0004	0-30V 3A Regulated DC Power Supply Unit	45.00
S0005	0-20V 20A Professional Regulated PSU with full protection circuit	134.00
S0010	+-0-50V/6A Heavy Duty Regulated PSU with protector circuit	159.95
S0011	6.5V to 18V/20A DC Regulated PSU	159.00
S0103	High Efficiency Fluorescent light driver	32.00

ASSEMBLED KITS — GENERAL CIRCUITS

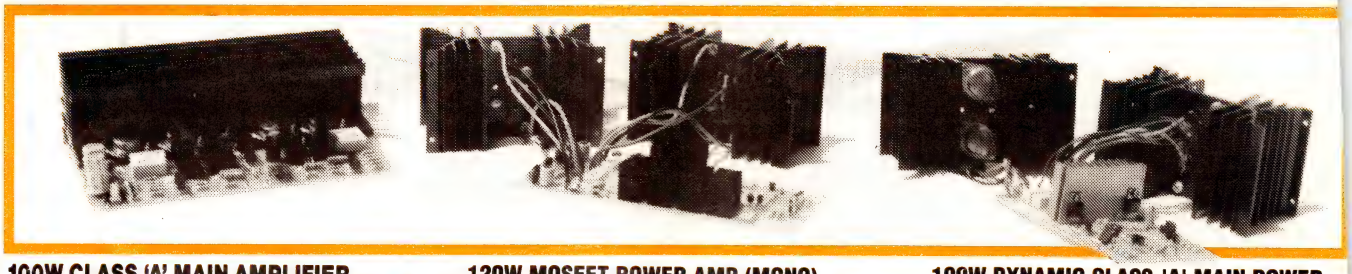
S0201	High Precision sound control switch	19.95
S0202	Sound or touch switch control	24.00
S0203	Infrared Remote Control Unit	49.00
S0204	Multipurpose melody generator 'A' (8-melodies)	17.00
S0205	Multipurpose melody generator 'B' (8-melodies)	17.00
S0206	Multipurpose melody generator 'C' (10-melodies)	19.00
S0211	AC/DC Quartz Digital Clock	27.50
S0212	Superior Electronic Roulette	37.50
S0213	Light Activated Switch	13.50
S0214	Multifunctional control relay	15.50
S0215	Digital voice recorder	79.00

ASSEMBLED KITS — DIGITAL PANEL METER

S0405	Multifunctional LED 3½ Digital Panel Meter	69.95
S0406	4½ High precision Digital Panel Meter	89.95
S0407	4½ High precision Digital Panel Meter with ABS case	99.95
S0408	3½ LCD multifunctional Digital Panel Meter with hold	67.00
S0402	3½ Digital Panel Meter	
S0403	Bar/Dot Audio Lever Display	
S0404	3½ LED Digital Panel Meter with hold	

ASSEMBLED KITS — AMPLIFIERS

ITEM #	DESCRIPTION	P
S0301	Stereo Pre-amplifier with magnetic mic. amplifier	
S0302	Speaker protector stereo	
S0303	35W pure class a main power amplifier mono	
S0304	Dynamic noise reduction system	
S0306	80W + 80W pure DC stereo power amplifier	13
S0307	NF-CR 8I-FET Pre-amplifier (with 3-way tone control)	8
S0308	State of the art full complimentary symmetry FET stereo pre-amplifier	19
S0309	60W + 60W OCL DC pre-main & stereo amplifier	11
S0310	100W dynamic class a main power amplifier mono	9
S0313	100W fully symmetrical class a power amplifier mono	9
S0327	20W PA amplifer	3
S0328	40W walkman booster	62
S0329	120W mosfet power amplifier	209
S0330	Super class 'a' DC fet pre-amp	175
S0331	300W HQ Power Amplifier	209
S0333	1W Mini Mono Amplifier	14
S0334	6W Mini Mono Amplifer	19
S0335	12W Stereo Power Amplifier	37
S0336	30W Amp with Tone Control and Mic. Input	42
S0337	30 + 30W High Quality Stereo Amplifier	77
S0338	40W PA Amplifier with 3-way Tone Control	58
S0339	40 + 40W OCL Power Booster	59
S0340	140W Modified Class A Main Power Amplifier	169
S0341	100 + 100W Class A DC Stereo Pre-main Amplifier	199
S0342	120W/250W Mosfet Mono Power Amplifier	228
S0343	300W Mosfet Hi-fi Mono Power Amplifier	299



100W CLASS 'A' MAIN AMPLIFIER (MONO) S0313 $99.00

Power Output:	100W 8 OHM
Frequency Response:	0-100KHz
Input Impedance:	22K.
Input Sensitivity:	0.8V
Supply Voltage:	DC+/-30 -42V(MAX)
Current:	5A
Power Bandwidth:	5-50KHz
THD 1KHz 1W:	0.001%
Transformer:	28Vx2/5A
Recommended Transformer:	30+30V/160VA. (T0209) MONO
Recommended Transformer:	30+30V/300VA. (T0217) STEREO

120W MOSFET POWER AMP (MONO) S0329 $209.00

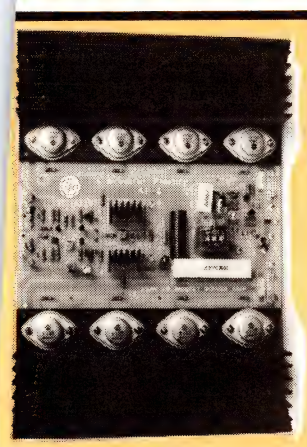
Power Output:	120W RMS into 8 OHMS
Frequency Response:	8Hz to 20KHz, +0 to 0.4db
Input Sensitivity:	1V RMS for 120W Output
Power Requirement:	+/- 45 to 55 VDC at 3A Mono 40Vx2/3A/160VA for MONO 40Vx2/6A/300VA for STERO
Recommended Transformer:	40+40V/160VA. (T0212) MONO 40+40V/300VA. (T0219) STEREO

100W DYNAMIC CLASS 'A' MAIN POWER AMP (MONO) S0310 $99.00

Power Output:	100W RMS into 8 OHM .150W RMS into 4 OHM
Frequency Response:	10Hz to 20KHz
T.H.D.:	Less than 0,008%
TID:	Less than 0.008%
Input Sensitivity:	0.75V – 1V
S/N Ratio:	Better than 80db
Power Supply:	+/-35V TO +/-45V DC
Power Consumption:	3.5A per channel.
Recommended Transformer:	30+30V/160VA (T0209) Mono
Recommended Transformer:	30+30V/300VA (T0217) STEREO

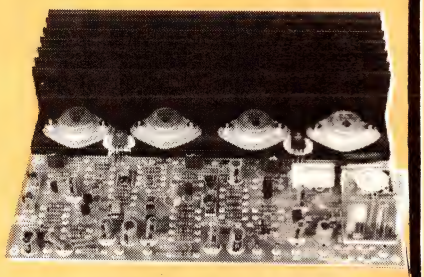
A-ONE A-ONE A-ONE A-ONE

A-ONE A-ONE A-ONE A-ONE



S0343 $299.00

S0342 $228.00



300 WATT MOSFET AUDIO POWER AMPLIFIER

ecent developments in high fidelity sound reproduction stems have occurred which place stringent demands on e power amplifier. Discriminating listeners have scerned subtle differences between solid state and cuum equipment and most of them seem to prefer the cuum tube sound. Moreover, the demand for ever higher tput power has increased steadily.

here is now available the power MOSFET transistor which an provide extremely high output power together with the rtues of vacuum tube sound. However, in order to attain he high performance of which these devices are capable equires careful circuit design.

The acoustic fidelity laboratory design engineers have onducted extensive design and test activity in order to roduce a superb product for the do it yourself audio nthusiast. With a reasonable amount of care taken in its construction, an amplifier rivalling the top of the line equipment may be realised at an extremely modest cost.

Specifications:

Power Output: 300W into 4 Ohms (0.1% THD)
200W into 8 Ohms (0.02% THD)
Frequency Response: 10 Hz - 20 KHz
Total Harmonic Distortion Less than 0.03%
Input Sensitivity and impedance at 1 KHz, 1V 47 K Ohms
Load Impedance: 4 - 16 Ohms
Power Requirements: ±55 to ±65V DC 8 A (Each Channel)
Dimensions: 287 x 205 x 60 mm
Weights: 4.62 lbs (2.1 kg)
Recommended Transformer: 45V + 45V, 500VA (T0265)

A TOTAL MIRROR-IMAGED, FULLY COMPLEMENTARY, 250W RMS, MOSFET AUDIO POWER AMPLIFIER

Power Outputs: 120 Watts (RMS) into 4 Ohms,
80 Watts (RMS) into 8 Ohms,
When 33V + 33V AC, 220W power transformer is used.
250 Watts (RMS) into 4 Ohms,
150 Watts (RMS) into 8 Ohms,
When 42V + 42V AC, 500W power transformer is used.

Frequency Response: 3Hz – 22,000Hz (±0.8dB)

Total Harmonic Distortion: Less than 0.03%

Input Sensitivity: 1 Volt input for full rated-output, at 1kHz, into 47K Ohms.

Load Impedance: 4-16 Ohms.

Power Requirements: 33V + 33V AC, 220W (Each channel) or
42V + 42V, AC, 500W (Each channel) or
±46VDC, 4A, ±60V DC 6A (Each channel)
(the a/m DC Voltages were measured at empty load)

Dimensions: 205 (W) x 60 (H) x 165 (D) mm

Weights: 2.64lbs (1.2kg)

Recommended Transformers:
30V + 30V, 225VA (T0242)
or 40V + 40V, 500 VA (T0264)

+/- 0-50V 6A REGULATED PSU
S0010 +$159.95

+/- 50V/6A DC Power Supply

5A RMS Regulated output per Rail

O/P Per Rail

Output voltage: +-0-50V DC (+-0-35V 5A RMS Regulated)

Current: 2A, +2A=4A, +2+2=6A

Overload Indicator: Current Limit
Sharp cut out

Output reset turn the selector to current limit point.

I/P Transformer: 30-35Vx2 15A 500VA

Recommended: 30+30V/500VA (TO262)

STEP-DOWN TRANSFORMERS 240V TO 110V AC

Many people come back from an overseas trip with audio, video or computer equipment which will only run at 110V. They get caught. But all is not lost and some of this equipment will run quite happily via a 110V isolation transformer. Pictured is one of a range of 110V isolation transformers manufactured by Harbuch Electronics. All are based on the company's toroidal transformers and thus they are compact and have a low residual hum field. Units are available with ratings of 60VA, 120VA, 300VA, 500VA and 625VA. The units up to 300VA are all housed in the same size case, measuring 125 x 75 x 185mm.

Cat. No.	Rating	Price
T0301	60VA	$125.50
T0302	120VA	$128.50
T0303	160VA	$138.50
T0304	300VA	$149.50
T0305	500VA	$183.50
T0306	625VA	$199.50
T0307	1KV	$349.50

Call for prices of other ratings.

A-ONE

ELECTRONICS PTY LTD
432-434 Kent Street,
Sydney NSW 2000.
Phone: (02) 267 4819.
Fax: (02) 267 4821.
A.C.N. 003 882 513.

MAIL ORDERS WELCOME:
CHEQUE, MONEY ORDER, AMERICAN EXPRESS, BANKCARD, MASTERCARD AND VISA.

POSTAL CHARGE
$5-25.....$4.50
$26-$50.....$5.50
$51-$100 .....$7.00
Over $100.....$10.00

Phone or write to us for a copy of your price list. Shop hours Mon-Fri 9-6. Sat 9-4. All prices include sales tax.

A-ONE A-ONE A-ONE A-ONE

Manufacturer's data on the LM1875 20W audio power amplifier IC

As used in the amplifier module elsewhere in this issue, the LM1875 IC requires only a few external components to deliver 25W into 8 ohms. It has quite impressive specifications for its size, as well as in-built thermal & short circuit protection.

By DARREN YATES

The LM1875 Audio Amplifier IC from National Semiconductor is now a few years old but it is still one of the most cost-effective devices available when it comes to simplicity and output power.

The LM1875 comes in a 5-lead TO-220 package. The heatsink tab is connected to the negative supply rail of the amplifier (ie, to pin 3). However, it must be isolated from the heatsink via a TO-220 insulating kit otherwise earth loops are likely to be a problem. Incidentally, even if this IC is not driving a load, it must be bolted to a heatsink as the quiescent current of 70mA is enough to cause the thermal protection circuitry to switch in (more on that later).

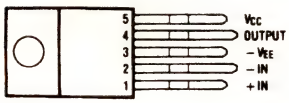


Fig.: this diagram shows the pinout details for the LM1875. The device must be isolated from its heatsink using a TO-220 mounting kit.

Main features

The main features and specifications of the LM1875 are as follows:

- Up to 30W power output into 8 ohms;
- Typical harmonic distortion of 0.015% @ 1kHz, 20W output;
- Short circuit protection;
- Supply voltage range of 20-60V;
- 94dB supply rejection ratio;
- In-built thermal protection;
- Low noise (S/N ratio in excess of 100dB);
- Open loop gain typically 90dB;
- 70mA (typical) quiescent current

The LM1875 can drive either 4Ω o 8Ω loads but it delivers slightly mor power into 8Ω loads. With 4Ω loads the maximum output power is 20W.

Although the data sheets indicat that the device can deliver a maxi mum output power of 30W into 8Ω this is at its absolute maximum sup ply voltage of 60V. With practica power supplies, some allowance must be made for variations in mains voltage and therefore 25W is a more realistic rating.

Single or dual rails

The LM1875 can be operated from dual or single supply rails and the amplifier module project featured in this issue shows both supply arrangements. The pinout diagram can be seen in Fig.1.

Fig.2 shows the internal circuit diagram of the IC. Two NPN devices, Q35 and Q39, are the output transistors. If you look closely, the emitter resistor for Q35 is split in half and this split feeds another NPN device, Q36, which monitors the output current on positive half cycles of the output signal. In fact, Q36 and Q37 form part of a "load-line" protection system which shuts down drive to the output stage if the

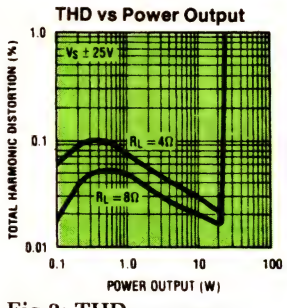


Fig.3: THD vs power output.

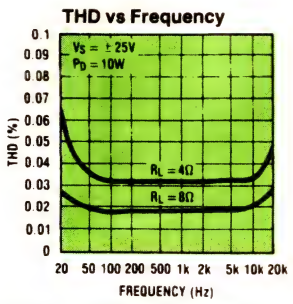


Fig.4: THD vs frequency for 4Ω & 8Ω loads at 10W.

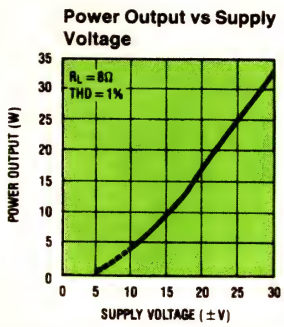


Fig.5: power output vs supply voltage (8Ω load).

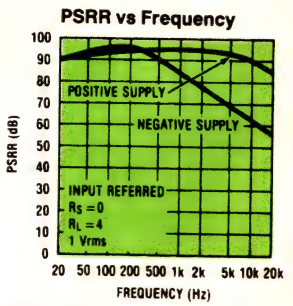


Fig.6: PSRR vs frequency (positive & negative rails).

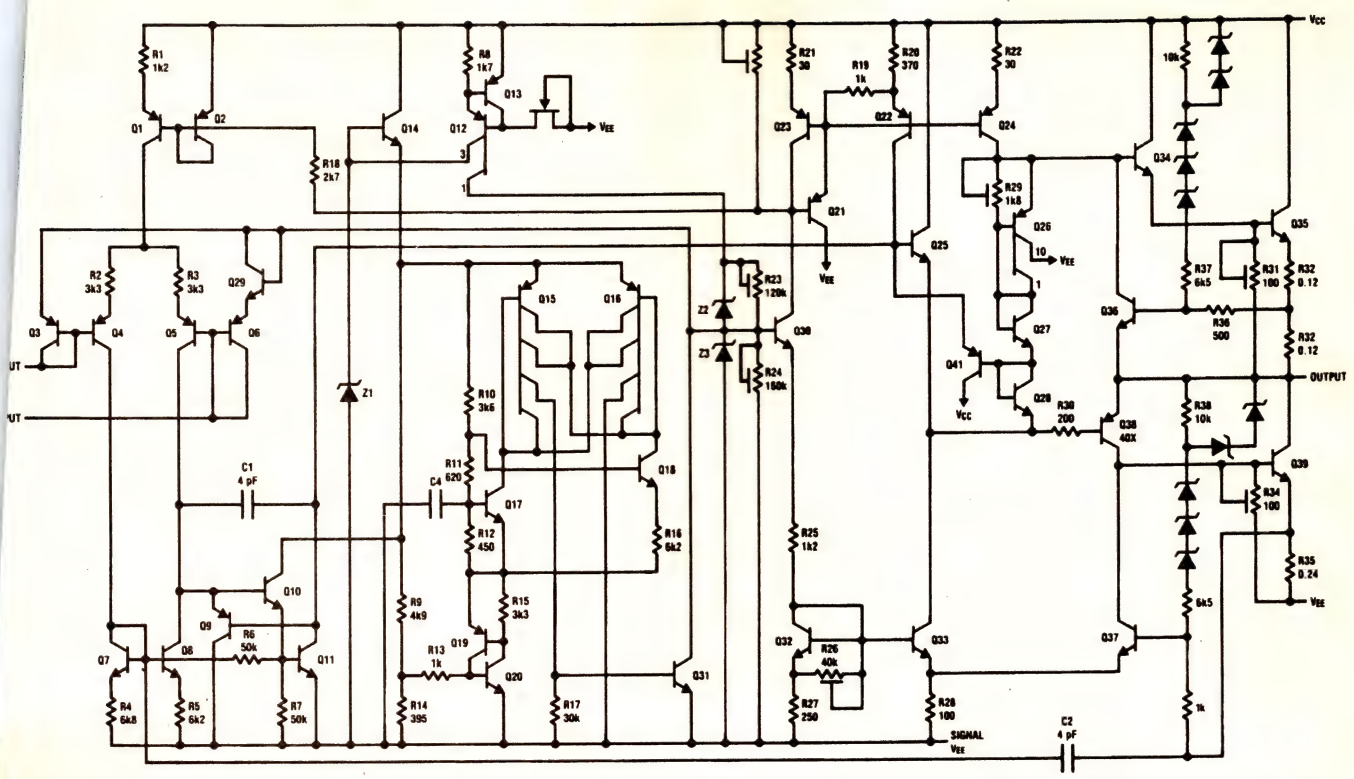


Fig.2: the internal circuit diagram of the LM1875. Q35 & Q39 are the output transistors, while Q36 & Q37 form part of a "load-line" protection system which shuts down drive to the output stage if the loading conditions are excessive.

loading conditions are excessive.

Fig.3 shows the distortion vs output power for both 4Ω and 8Ω loads while Fig.4 depicts distortion as a function of frequency. As you might expect, the device has increased distortion at both ends of the audio spectrum.

Power output

Fig.5 shows the expected power output at 1% total harmonic distortion for supply rails of between ±10V to ±30V (R_L = 8Ω). Power supply rejection characteristics vs frequency are shown in Fig.6. Note the difference between the positive and negative rails, with the negative rail being some 30dB or so worse at 20kHz. The maximum figure of 94dB is relative to a 0Ω signal source resistance, a 4Ω load and at a frequency of 1kHz.

The in-built thermal protection activates when the die temperature reaches 175°C and shuts down the device, which remains off until the die cools down to 145°C. In the case of a continuous load or over-drive problem, if the die rises to 150°C the device will again shut down. The beauty of this is that if the fault is a one-off event, the thermal circuitry will allow the die to heat up further than if it is a continuous fault.

Figs.7 & 8 show details on the power output vs power dissipation for 4Ω and 8Ω loads. Notice how the device dissipation is much higher for 4Ω loads. In fact, even with a 1°C/W heatsink, the LM1875's internal thermal shutdown circuitry switches on once the power output reaches 20W. By this stage, the power dissipation has reached about 32W and the die temperature has surpassed the 175°C mark.

With an 8Ω load, the LM1875 will happily deliver 25W continuously without running the risk of thermal shutdown.

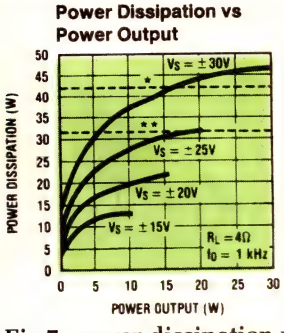


Fig.7: power dissipation vs power output (R_L = 4Ω).

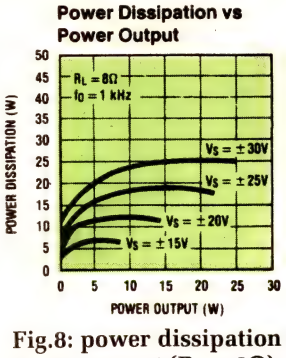


Fig.8: power dissipation vs power output (R_L = 8Ω).

Stability

Most power amplifiers don't drive capacitive loads all that well and the LM1875 doesn't either. Long speaker leads can produce enough capacitance to drive some amplifiers into VHF oscillation. In this case, the manufacturer's data sheets recommend that you add a Zobel network consisting of a 0.22µF capacitor and a 1Ω resistor to the output. This has been included in the amplifier module in this month's issue.

As with most designs, PC board layout is important in minimising the noise and distortion components. Keeping the input signal away from the supply rails will help keep the distortion low. **SC**

REMOTE CONTROL

BY BOB YOUNG

Servicing your R/C receiver

This month, we will look at the technical aspects of servicing the modern R/C receiver. Apart from using your eyes, the equipment required is a toothbrush, a can of CRC-226, a voltmeter, an oscilloscope & a signal generator.

To begin, one must keep in mind at all times that the receiver has lived out its entire operational life in an extremely harsh environment; usually subjected to high levels of vibration, high "G" forces, crash damage, plus possible water and dust ingress. As if this were not enough, receivers which fail in flight due to a simple component failure then have to undergo the trauma of a crash, before the wretched thing can be lobbed up on the bench of some poor serviceman, usually waiting with baited breath for the next horror story.

Servicing model equipment adds a new dimension to "Mondayitis". Every Saturday and Sunday, the weekend warriors are out there doing their thing, flying and crashing, racing and sinking, lead-footing and rolling. Every Monday the phones run hot with their horror stories.

"I was flying along, minding my own business, when this tree jumped in front of my model..." Or "I was in this pylon race and I accidentally backed into the propeller of the model behind me. Its prop chewed the leads off my servos and receiver and sliced the battery pack in half. In the crash which followed, the engine bearer smashed through the receiver case and broke some components. Do you think it will cost much to repair?" Or "I had my hydro howling and it hit a submerged log. It did a triple somersault and sank in 50 metres of salt water. It was only under the water for about two days before I could get it out. Do you think it is repairable? PS: you will notice the Rx case is a funny copper colour and another thing, I cannot seem to see any tracks on the PC board. I am sure they were there the last time I drained the water out of the receiver, after I collided with me mate's Deep V."

"I had my hydro howling & it hit a submerged log. It did a triple somersault & sank in 50 metres of salt water. It was only under the water for two days before I could get it out".

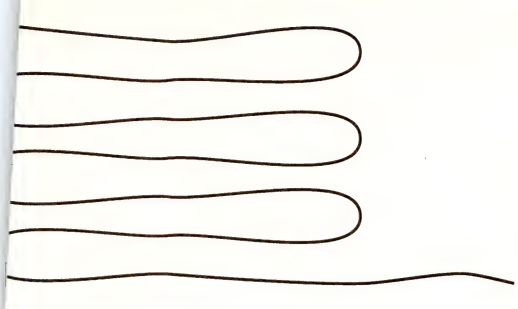
Don't laugh, I have had all of the above and more happen to me personally. In one horrific period, I lost six models in six consecutive flights. It was the closest I ever came to giving up flying completely. Oddly enough, they were mostly due to propeller breaking in flight. The models quit literally explode in mid air when prop sheds one blade.

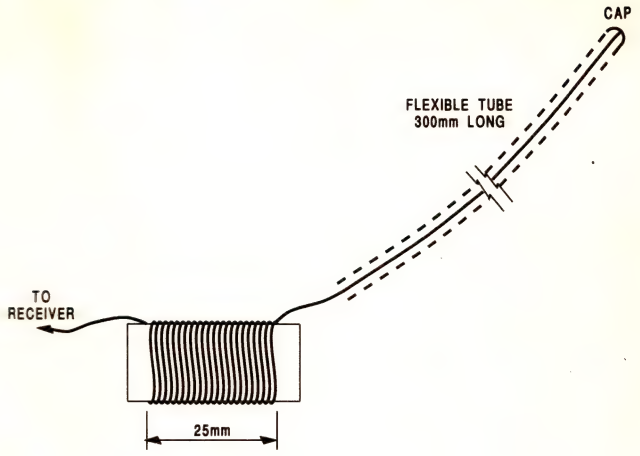
At the time, I was reworking bi motors for my speed runs and using nylon props. In the end, I tried virtually every brand of nylon prop on the market and was finally forced to use wooden props. These break easily on rough fields and the cost is very high. However, the cost of a lost model is even higher so I had to grit my teeth and persevere with wooden props. Nylon props have improved a lot since then but always make sure they are correctly balanced.

Crash hazards

The last crash in the series was the most galling, however. At the time I was training for the World Aerobatics Championships in Pennsylvania, USA (1971) and used to get up at 5am and drive to "Bedrock" for a session before work. I did this every day for three months. Now "Bedrock" (Heathcote Road, Sydney) was a dirt strip which used to grow a new crop of rocks overnight. I used to take a broom and sweep the strip every morning and every morning there would be a new crop of rocks.

This particular morning as usual, I stood at the side of the runway, midway along the strip, and taxied to the end of the runway to take off. I opened the throttle and began the take-off and as the model drew level with me, I spotted a new rock right in front of my prop. Too late – the prop shattered, the nose of the model disintegrated and the whole mess fell in a heap at my feet. It never even left the ground! I was hopping mad and one model short with six weeks to go to the championships.





g.1 (above): the end of the antenna is often glued to an luminium chassis in a zig-zag pattern, as shown here. This undesirable, as it allows noise pickup & cancellation in the ded sections, resulting in detuning of the front-end. Fig.2 at ght shows the correct way to deal with the antenna.

Such is the pressure on the dedi-ated contest flyer. You never knew hen the next blow would be struck. omehow you always made it to the ontest but the amount of midnight il used in the effort leaves one ex-austed.

However, the real point of this story s that the explosive vibration levels xperienced by models throwing a rop blade can be transmitted to the eceiver and servos. Also, the elec-ronics must survive the fall to earth. This must be kept in mind at all times when servicing model equipment.

With this background, we can now move on to the servicing of receivers. If the receiver is your own then you know its exact history and the prob-able cause of the problem. If the re-ceiver belongs to a friend or customer, then suspect everything! If the receiver comes from a model aircraft, then sus-pect everything, including the aircraft.

Non-electronic faults

To clarify this last point, another story is in order. By far the worst receiver repair I ever had to deal with belonged to a friend of mine and was one of my first Mark VII production receivers. Because of this, I had to be particularly careful about establish-ing the cause of the problem. Despite all the care lavished on prototypes and early production units, faults can easily slip through.

Anyway, the complaint took the form of a loss of control at the top of a loop. My friend swore blind that the fault had only begun to manifest itself in the last few weeks. Prior to that, the receiver had worked flawlessly. To compound the problem for me, in the earlier receivers we had an antenna phasing problem which caused a simi-lar result. I was sure the Mark VII receiver was free of this fault but one could never be sure.

After exhaustive testing, I began to suspect detuning due to engine vibra-tion or simple component degrada-tion and I went through that receiver with a fine tooth comb. I could not find a fault of any kind. Week after week this went on until finally, in exasperation, I went flying with him to see the problem for myself. Now this business of going with a customer is a real pain for it usually entails a 100km round trip in heavy traffic and blows away at least half a day. But sometimes it is unavoidable.

To cut a long story short, The model was a very fast swept wing semi-scale F-86 Sabre. As soon as I saw the model I knew what came next. Sure enough the loop was performed and the model did a perfect flick roll off the top of the loop. It wasn't loss of control in the true sense but a genuine flick-roll. As it turned out, Bill had moved the cen-tre of gravity (CG) back the week be-fore the problem began. The whole thing was an aerodynamic problem. Moving the CG forward cured the problem and I heard no more com-plaints about that particular receiver.

I have spent a considerable amount of time on the foregoing because these sorts of problems caused me endless trouble until I had gained sufficient experience to recognise this sort of fault. Filling out the complaint sheet correctly is a vital part of servicing in model work and the serviceman must stay alert to any external factors caus-ing what appears to be a purely elec-tronic problem.

Antenna installation

Antenna installation is a classic problem often encountered in model work. Most model receivers come with one metre of hookup wire for an an-tenna. The problem is that this is too long for many models, particularly model cars. Most cars come with a flexible tube about 30cm long into which the last 30cm of the Rx antenna is slid. What do you do with the ex-cess 70cm? You dare not cut the an-tenna short, for it will detune the re-ceiver front-end badly.

Now the ingenuity used by some modellers in devising the worst pos-sible use for this excess antenna often leaves me speechless. Usually it is wound up in a ball and left lying under the servos or some such electri-cally noisy device. Often it is glued to the aluminium chassis in a zig-zag pattern, as shown in Fig.1. This is undesirable, as it allows noise pickup and cancellation of the folded sec-tions, resulting in detuning of the Rx front-end.

The correct way is to make a small bobbin and drill two holes in each end about 25mm apart. Thread the end of the antenna through one hole and wind the excess into a coil on the bobbin. Thread the 30cm to be in-serted into the flexible tube through the other hole and Bob's your uncle. It makes a neat little antenna (Fig.2) which should be mounted well clear of servos, battery packs and inter-wiring. In electric models, keep it well clear of the speed controller and mo-tor batteries as well. All of these de-vices generate electrical noise and will interfere with the receiver.

I cannot stress too strongly that the best reception is achieved with the maximum length of antenna, in the clearest location possible. On aircraft, a 90 degree change in direction is

permissible (from cockpit to fin and down to the tip of the tailplane) but do not fold the antenna back upon itself more than about 5cm. The maximum which can be cut off most receiver antennas without serious receiver detuning is about 10cm. This often occurs during a crash and is a commonly asked question.

Grilling the modeller

Therefore, from my point of view, the first step in receiver servicing is to grill the customer on the symptoms and establish the nature of the fault. Be sure to ask if there have been any changes to the model prior to the fault appearing. Changes in antenna location, CG of the model or new servos can all introduce problems.

Battery problems

Always be alert to battery problems as they are very high on the list of probable causes, although not as high as in the transmitter. Crash damage and engine vibration radically alters the statistical analysis of fault probabilities. Make sure you get the battery pack used during the flight when the fault occurred. Often, the model battery pack is difficult to remove and the modeller will send in a spare pack. If the fault is in the battery, you can spend a lot of time on a wild goose chase.

I will not give a warranty on a repair unless I can examine the actual batteries to be used. Always be aware that the industry standard for average battery consumption for a flight battery is 270mA, as against approximately 120-150mA for the Tx. This means that the receiver battery is the shortest duration member in the Tx/Rx battery pair. Also be aware that this will vary depending upon the number of servos and the style of flying of the operator.

A fault occurring at the end of eight 15 minute flights often indicates that a battery has gone flat. Check the capacity of the battery with a cycling charger or a graph. I routinely graph all batteries sent in for servicing. Do not forget to ask if the battery charged correctly and fully the night before. Batteries charged and left to stand for a week will self-discharge and this will influence flight duration.

A slope soarer (with two servos) flown gently will last about 3.5 hours on a 500mAh battery pack. A 4-servo pattern ship flown vigorously will last about two hours and a helicopter with four servos about 45 minutes. The corollary to this is that the servos in each of these models will be subject to different rates of wear. In addition, helicopters are subject to a lot of vibration. Be sure to find out what type of model your customer is flying.

If the model comes in as well, I look at the antenna and advise the customer on the correctness of the installation. In this regard, I always routinely replace the receiver antenna on the grounds that it gets severely stressed in a crash; I often find the conductor broken inside the insulation.

"Always be alert to battery problems as they are very high on the list of probable causes. And make sure you get the battery pack used during the flight when the fault occurred".

Receiver checks

Finally, it is time to move onto an examination of the receiver. Regardless of the nature of the complaint lodged by the customer, begin with a very close physical examination of the receiver case, its PC board and components. Often, old crash damage has been missed or has just become obvious.

Look for impact marks on the case. Plastic cases often return to shape after an impact, leaving almost no trace of the object which distorted the case. Aluminium cases were better in this regard, as they were stronger. They also protected against electrical n and left marks if a sharp object pacted with the case.

The real danger here is that delic components which are unsuppor inside their housings, such as cryst and IF coils, can be cracked interna and it is difficult to check on this vibration table is a great help and w often show up this type of fault, wh freezer cans can be of help too.

Next, move to the servo leads pins and give them a visual inspe tion and a good scrub with a toot brush and CRC-226. Remove any du or dirt and inspect the PC board f corrosion. Often, receivers are pu chased secondhand and whilst th current owner may be using it in a aircraft, the previous owner coul have had it in a submarine, with n waterproofing!

Be suspicious of everything is m motto. Somebody bringing back model and radio that you have jus serviced – in a bucket – is no joke. once had an alcoholic customer wh did just that. Some modellers really take their modelling seriously and faults in the radios or servicing are never forgiven.

Next, cut open the receiver battery pack and examine the cells individually for signs of corrosion or physical damage. If there are signs of damage, discard the pack. Damaged cells will often let go in flight under engine vibration with disastrous results. Short circuited cells are a common problem in airborne battery packs. Do not replace a single cell as this will often result in unequal stress on that cell and premature failure of the pack.

Pull back the insulation on the battery leads and examine them for "black wire" corrosion. Examine the battery connector for signs of damage or corrosion. Water on the connectors will result in electrolysis and damage to the pins. Always be on the alert for this type of problem.

Finally, charge the pack and check each cell voltage. They should be within 0.07V of each other. Any cell showing a greater deviation than this is suspect. The actual terminal voltage will depend upon the internal chemical composition of the cell. This will vary from brand to brand but most will come off the charger at about 1.35-1.4V per cell.

That's about it for this month. Be sure to keep those nicads cycled. **SC**

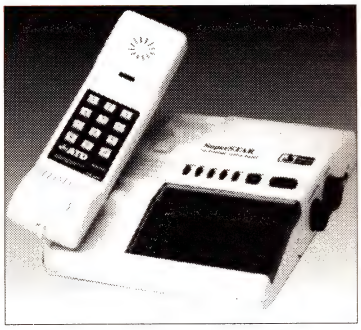
R ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS
R ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS
R ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS

CHRISTMAS GIFTS FROM JAYCAR

BARGAIN PRICED TELEPHONE PRODUCTS

Jaycar has purchased a quantity of telephone products from ATD. These have been returned to ATD from large retailers who have declared them faulty. These are checked and many are found to be OK, the faulty ones are fixed. They can't be sold as new because they may have a mark on them and probably have no box. All units are supplied with instructions and accessories. All goods have a 30 day replacement guarantee. The Cat #: YT-7082 has an additional subsidised warranty for another five months. This is $25 repair charge plus freight. The goods offer fantastic value for money.

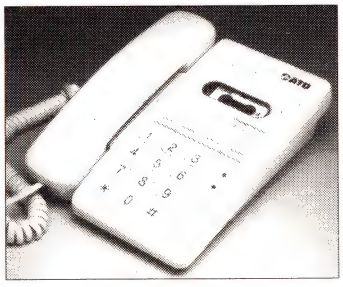
TELEPHONE CLOCK RADIO



The price is so low, we must be mad!! Buy 2, one as a spare! Features: Clock Radio • one touch control buttons • large radio on/off selector • wall or desk mountable • large LED clock with display • PM/alarm indicators • rotatable clock display • LED radio tuning indicator • battery backup • wake to alarm or radio • automatic radio muting for incoming calls • radio music on hold • snooze facility Telephone • ringer on/off • ringer indicator • mute & last number dialled functions • 30 day exchange warranty. No fixee after that. Reworked stock. - STILL SELLS FOR $65

Cat. YT-7084 **only $19.95**

COMBINED PHONE & REMOTE ANSWERING MACHINE



The Phonewatch 1830 gives you the benefit of the following features:- Telephone: • Last number redial •Tone/pulse switching • Ringer on/off • Wall mountable. Answering machine features: • Digital recording of outgoing messages • Remote turn on/off • Toll saver feature • Memo recording • Call screening • Voice activated recording • One touch playback • Built-in microphone • Two-way record • Remote access to play incoming messages • Message indicator • House monitoring • Call breakthrough - priority breakthrough. Supplied with mains plugpack, telephone lead, tape and instructions. Re-worked stock. 30 day exchange warranty. For next 5 months special repair price $25.

Cat. YT-7082 **Now Only $69.95 Was $89.95**

Bargain Priced ATD Answering Machine

The ATD 1800 is a very popular answering machine. All the big stores and discounters sell it for $99. These are in our catalogue for $59.95 and we have sold hundreds. Features: •memo recording •digital recording of outgoing messages •call screening •voice activated recording •built-in mic •message indicator & number of calls. We've been able to further reduce our price of this machine. All units are supplied with instruction manuals, phone lead and power plugpack. Three month replacement warranty applies to this product. Probably Australias best selling machine. Re-worked stock.

Cat. YT-7028 **only $49.95**

METEX 4.5 DIGIT RS232 DIGITAL MULTIMETER SALE

Features:
•Bargraph •Frequency •Transistor •Logic •Relative Offset •20 Amp Current •Carry Case •Overload Protection •Data Hold •Min/Max Hold •Diode and Continuity •Range Selector Beeper. - See catalogue for full details.
Cat. QM-1460

Was $269.50 X'mas Special $239.50 Save $30

SAVE 10% ON VIFA SPEAKER/ CABINET KITS

If you purchase a set of Vifa speaker kits with cabinets this month take 10% off. Prices are due to rise soon. Don't miss out.

Kit #: SA50	**Normally $369**	**Now Only $332.00**
Kit. #: SA70	**Normally $449**	**Now Only $404.00**
Kit. #: SA100	**Normally $699**	**Now Only $629.00**
Kit. #: SA130	**Normally $999**	**Now Only $899.00**

All prices are for complete kits - speakers, crossovers and cabinets. Discount only applies to full kits. See catalogue for full details.

OUTDOOR GARDEN OR X'MAS LIGHTS

NEW

150 LIGHTS!!! These are bigger, better and cheaper than our old model that we had so much trouble getting. Have the best looking garden in the street. Completely prewired - simply hang them through your garden. Safe, low voltage (24V) supplied with a mains 240v plug pack.The set consists of a 240v plug pack, 15 metres of plain cable and 21metres of cable with the 150 globes at 140mm spacing. All cable and globe bases are green so it easily hides in the garden. Current drain for all 150 globes is approx 2.1 amps.

Cat.#: SL-2830 **Perfect For X'mas - Only $69.95**

UHF PHASED ARRAY TV ANTENNA

Phased Array (or flat reflector) TV antennas are designed to give increased performance in poor reception areas, or where the signal tends to vary or fade. This is a quality European made product.

SPECIFICATIONS:

Bandwidth	470-862Mhz
Dimensions	500 x 760mm
Gain	9-12dB
Front to Back Ratio	>18dB
Wind load at 120KMH	5kg
Reflectors	Plastic covered steel
Elements	Zinc plated
Mounting	Dia max 60mm

Cat. #: LT-3185 **$69.95**

NEW

SW/AM/FM MINI RADIO

Listen to the world. Features AM/FM and shortwave band (3.1 to 17.6MHz). All packed into the smallest multiband radio we've seen. Measures only 125(W) x 70(H) x 28(D)mm.
Features include: LED band indicators, feather touch selector, micro size, telescopic FM-SW antenna, carry strap, earphone jack. Operates on 2 AA batteries. Bargain price.

Cat. AR-2200 **only $42.95**

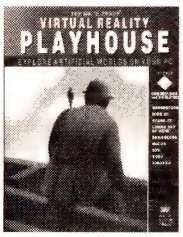
NEW

JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS
JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS
JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS

JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECT
JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECT

NEW BOOKS - NEW BOOKS - NEW BOOKS

VIRTUAL REALITY PLAYHOUSE



INCLUDES DISKS AND THREE "D" GLASSES.
EXPERIENCE VIRTUAL REALITY NOW!!!
With this book you can: •Design 3 dimensional anaglyphic images then make them spin in **Wire-3D**. •Walk, fly or drive through a virtual city while indefinitely changing the cameras point of view with **SuperScape**. •See the future of Virtual Reality role-playing games with **Lemme Out Of Here!** •Learn how 3-D simulators work with **Mig-29** and **Continuum**. •Demonstrate stereoscopic imagery without 3D glasses using **Julesz** images with the unique **Stare EO**. •Learn how to build your own 3-D shuttering glasses and push your perception to the limit with **3DGV**. Amazing software - 3D glasses - fascinating writing about a fantastic topic. **Warning: Once you enter the Virtual Reality Playhouse everyday reality will never be the same!!!**

NEW

143 pages - softcover - 177 x 230mm. Cat. BW-3504 **JUST $47.95**

VIRTUAL REALITY CREATIONS

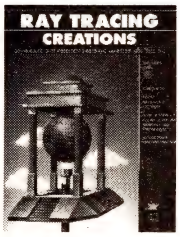
EXPLORE, MANIPULATE AND CREATE VIRTUAL WORLDS ON YOUR PC.
Build your own virtual world, then walk, run or fly through it with Virtual Reality Creations. Using the REND386 software provided in this book, its simple to design custom 3-D worlds on your 386 or 486. Construct architectural mock ups, machine simulations, molecular models, video game flybys and much more. A special Fresnel 3-D viewer gives you the full stereo experience of the REND386 program. Virtual Reality Creations offered 3-D development guidance for an insiders look at the state-of-the-art Virtual Reality technology. You'll explore professional products such as VREAM and Superscape, and learn about the latest areas of Virtual Reality development. Using REND386, you'll experience 21 predefined virtual worlds in the book. Inc. 5.25" disk. Softcover - 591 pages - 225x175mm

Reality

NEW

Cat. #: BW-3510 **only $69.95**

RAY TRACING CREATIONS

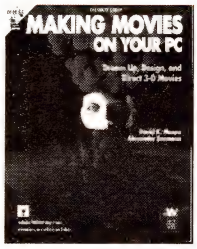


GENERATE 3-D PHOTOREALISTIC IMAGES ON YOUR PC
This hands-on book / disk transports you inside the world of photorealistic 3-D images and surreal surroundings. Ray Tracing Creations teaches you how to simulate real-world lighting, surface texture, transperancy, reflection and refraction in your other-worldly PC universe. The bundled disk contains the Persistence of Vision Ray Tracer (POV-Ray) software with over 100 pre-built scenes, 50 standard materials (chrome, glass, marble, wood etc) and prefabricated objects to make shells, trees, serpentine monsters and letters of the alphabet. And if you need further inspiration we've thrown in a colour collection of fantastic ray-traced images. Check out the colour plates to see the potential. Inc 3.5" disk. Softcover - 573 pages - 225 x 175mm

NEW

Cat. #: BW-3508 **only $79.95**

MAKING MOVIES ON YOUR PC

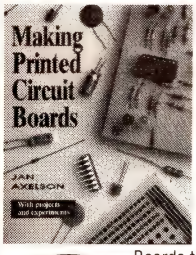


DREAM UP, DESIGN AND DIRECT 3-D MOVIES
This book and disks are a complete kit for anyone interested in developing computer based animation - no programming is needed - and all the tools you need are here. With POLYRAY and its associated programs, you'll create dazzling animations, mind boggling morphs and scintillating special effects. Simple step by step instructions, ready to run examples and expert tutorials guide you through the process of making your own eye-popping 3-D flicks. Includes 2 x 5.25" disks. Softcover - 210 pages - 225 x 175mm

NEW

Cat. #: BW-3512 **only $69.95**

MAKING PRINTED CIRCUIT BOARDS



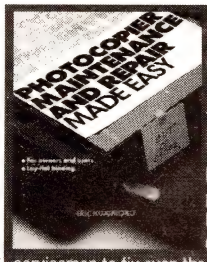
AT LAST A GOOD BOOK ABOUT MAKING YOUR OWN PC BOARDS.
Making Printed Circuit Boards takes you step by step from schematic diagram to finished project. You'll learn how to: •Draw circuit diagrams •Transfer artwork to PC blanks •Etch copper patterns •Drill holes for leads and mounts •Solder components to the board •Repair and modify boards •Use CADD software and photography to design circuits •Make double-sided boards •Choose and use photoresists •Working with surface-mount components •Safety/disposal of etching chemicals.

NEW

Softcover - 327 pages - 235 x 185mm

Cat. #: BT-1376 **only $39.95**

PHOTOCOPIER MAINTENANCE AND REPAIR MADE EASY



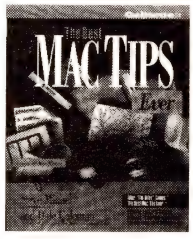
Every business has at least one photocopier. And they ALWAYS breakdown. Service companies charge a fortune to send out servicemen to fix even the smallest problem. Although a photocopier may look complicated, you can keep it running trouble-free. No experience necessary. With this book, a few low cost tools and cleaning supplies, you'll be able to locate and solve most of the problems you'll ever encounter. Step by step instructions show you how to trouble-shoot and repair the basic components found in virtually all photocopiers including: •Drums •Cartridges •Developer mechanisms •Fusing mechanisms •Cleaning and erasing units •Electronic and sensor devices •Paper transport systems.

Softcover - 197 pages - 235 x 185mm

NEW

Cat.#: BT-1380 **$32.95**

THE BEST MAC TIPS EVER



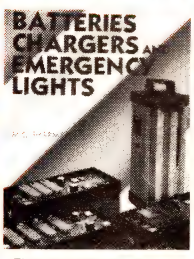
Now matter how well or how little you know the Mac, this book contains an abundance of tips that are guaranteed to increase your productivity. •Get the run down on using system software basics •Find out the most productive ways of using the Finder •Discover tips on using other system software, inc Quicktime, Applescript& Apple Easy Open •Gain control of printing & fonts with insight into TrueType/Postscript fonts •Learn how to network and exchange files with PC's •Uncover application tips you can put to use no matter what word processing, database, graphics or spreadsheet program you use •Improve the ergonomics of your work environment •Learn how to synchronize files, maximize battery life & more on the PowerBook •Covers all Mac models.

NEW

Softcover - 230 x 185mm Cat. #: BT-1374

only $39.95

BATTERIES, CHARGERS AND EMERGENCY LIGHTS

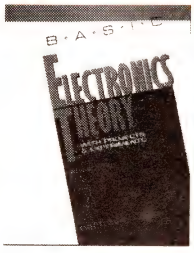


Battery Power in this age of micro-electronics is becoming increasingly important. This book provides essential information to the user of batteries and battery operated devices. The chapters include: •Cells and batteries •Primary cells •Rechargable cells •Battery eliminators •Voltage monitors •Charging systems •Lead acid battery chargers •Nickel cadmium battery chargers •Inverters and converters •Emergency lights •Fluorescent tube emergency lights •Trouble shooting and maintenance. An excellent publication and at a very reasonable price. Softcover - 245 pages - 220 x 140mm

NEW

Ct.#: BM-2484 **$19.95**

BASIC ELECTRONICS THEORY



WITH PROJECTS AND EXPERIMENTS
If you are new to electronics and want to learn basic electronics theory then this is the book for you. No previous electronics knowledge is necessary. It covers all major areas of electronics starting with electrons and Ohms law and gradually working through all aspects of electronics and components. An ideal book for the new hobbyist and those who just want to increase their knowledge on most aspects of electronics. Some of the chapter headings include: •Electrons •AC current •Capacitance •Magnetism •Inductance •X'formers •Crystal meters •Semi conductors •LED's •IC's •Power supplies •Radio/Stereo/VCR's.

NEW

Softcover - 692 pages - 235 x 185mm

Cat. #: BT-1378 **only $49.95**

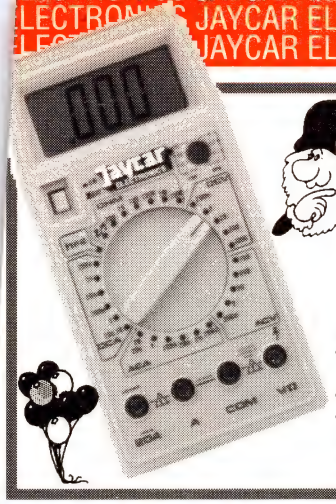
18/36 WATT FLURO INVERTER KIT

This kit was advertised last month. There is supply problems with the Philips Mosfet, and there is no usable equivalents. These are due in March. Sorry for any inconvenience caused.

JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS
JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS
JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS

JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS

DIGITAL MULTIMETER BREAKTHROUGH!!!



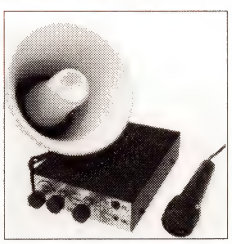
Jaycar Electronics are proud to announce a brand new range of DMM's that offer features per dollar that until now, was unheard of. Jaycar are sole representatives of this new range, which at the moment has three models, with more due in 1994. These two new ones introduced here are due in the first week of December 1993.

QM-1300
•30 range •Large 21mm display •Transistor test •Audible continuity test •20 amp
Cat. #: QM-1300
only $49.95

Jaycar ELECTRONICS
NEW PRODUCT RELEASE

QM-1310
•Frequency •Capacitance •Transistor •21mm display •Audible continuity test •Auto power off •20 amp
Cat. #: QM-1310
only $79.95

MOBILE PA AMPLIFIER WITH SOUND EFFECTS

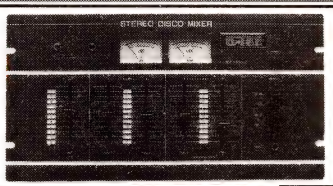


This amplifier system includes 5 different siren sounds and 5 animal sounds. All those are amplified and reproduced through the 10 watt PA horn supplied. A microphone is also supplied for the PA facility. The siren sounds are: •warbler •siren •police •ambulance •machine gun. The animal sounds are: •cat •cow •sheep •dog •chicken. Supplied with under the dash mounting brackets. Cat. #: AA-5000

was $69.95 now $54.95 save $15

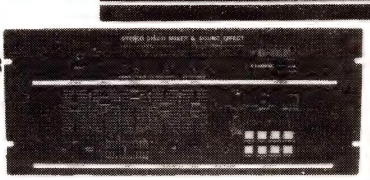
MIXER BARGAINS

If you have been considering buying a Stereo Audio Mixer, don't wait any longer. We have reduced the price of our two best selling mixers for a short time only. For full specs see our 1993 catalogue.



6 INPUT
Cat. #: AM-4202
was $169 now $129 save $40

8 INPUT
EQUALIZER & TALKOVER
Cat. #: AM-4208
was $249 now $199 save $50



WE ALSO HAVE AN EXTREMELY SMALL QTY OF 10 INPUT UNITS
Cat. #: AM-4210
was $329 now $279

VIDEO TRANSFER SYSTEM

NEW

TRANSFER FILMS, SLIDES AND PHOTOS TO VIDEO

If you have large collection of slides or prints and never look at them or show them to friends and family because it's too much hassle, then this Transfer System may change your mind. To transfer slides for example, you simply load them into your projector as normal, and face it into the window on the side of the Transfer System. Then face your camcorder towards its window and start recording. Each slide should be recorded for about 8 seconds. Then simply dub to a standard video tape for viewing anytime. You can narrate them as you go, or later dub them through one of our video mixers and add background music and narrative. The Transfer System has a built in fluorescent light which is needed for transferring prints. This requires 2 x 9v batteries or a 9v 300mA AC adaptor (our Cat. #: MP3007 $15.95). Size: 260(L) x 200(W) x 160(H)mm.

Cat. #: AV-6450 **$129.50**

UNIVERSAL VIDEO BATTERY CAR CHARGER / DISCHARGER / POWER SUPPLY

NEW

•This universal charger will: - •Accept most camcorder batteries. These include Sony 8mm NP-22, NP-55, NP-66, NP-77 6 volt, Panasonic / JVC VHS-C 6 volt, Canon 8mm 6 volt, Olympus, Nikon, Elmo, Chinon 8mm 7.2 volt, RCA / Hitachi 8mm 6 volt and all 9.6 volt VHS and VHS-C batteries. •Discharge and charge all of the above from your car cigarette lighter or 12 volt DC source - even a 240 volt plugpack 12VDC 1000mA (use slow charge mode only) Cat MP-3015 $24.95. •Two charging times available - emergency QUICK charge in 20 minutes or NORMAL charge about 1-2 hours. •Power your 6, 7.2 or 9.6 volt camcorder from your cars power through this supply. IE: it will reduce the cars 13.8 volt down. Supplied with car cigarette lighter power lead and instructions. Cat. #: MB-3520 **$59.50**

FLUSH MOUNT SPEAKER KITS

These speakers are waterproof, polypropolene coated woofers and 1" dome tweeters. They are premounted and wired with crossovers. The grill is removable and can be painted. And they sound rather good.

6.5" SYSTEM

•Woofer - 6.5" polypropolene •Tweeter - 1" dome •Impedance - 8 ohm •Freq Response - 55Hz to 20kHz •Sensitivity - 90dB •Power handling - 40 watts RMS •Dimensions - 300(L) x 216(W) x 76(D)mm
Cat. #: CS-2422
were $179/pr now $139/pr save $40

8" SYSTEM

•Woofer - 8" polypropolene •Tweeter - 1" mylar dome •Impedance - 8 ohm •Freq Response - 55Hz to 20kHz •Sensitivity - 90dB •Power handling - 50 watts RMS •Dimensions - 356(L) x 254(W) x 95(D)mm
Cat. #: CS-2424
were $199/pr now $159/pr save $40

VIDEO CAMERA BATTERY

This battery is a universal type that fits Sony, Panasonic, JVC, Hitachi & Canon camcorders. It is 6v, 2000mAh and it uses quality Japanese cells. Size: 90(H) x 45(W) x 43(D)mm. Cat #: SB-2320.

Only $69.95

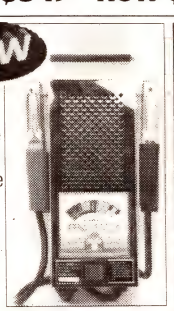
SAVE $50 ON COMMA CORP FAX MODEM 9600

The Comma Fax/Modem will turn your PC (or Mac) into both a 9600 baud fax machine and a modem which supports both 1200 and 2400 baud. Your faxes can now be sent directly from your PC without having to print them first. The Comma Fax/Modem not only uses the latest digital signal processing to ensure lasting trouble free operation but is a fully AT command compatible modem. Features include V22/V22bis standards as well as auto answer, dialling and disconnect when combined with the supplied software. You will also find it is compatible with all other popular communication software. •Supplied with QL2 software featuring both pull -down & mouse support.

Cat. #: XM-5000 **was $349 now $299 save $50**

CAR BATTERY TESTER

NEW



Ideal for testing both 6 & 12 volt car and maintainence free batteries as used in solar power installations etc. It will check batteries with ratings up to 1,000 CCA (Cold Cranking Amps) by drawing current (up to 100 amps) while measuring the voltage level. It will also check the batteries cranking ability, the vehicles charging system output and the starter motor. Its simple to use, portable, external power is not required and complete tests on a battery can be done in 30 seconds.It also features a shock resistant movement, heavy duty copper plated clamps and a heavy duty nickel-chrome plated steel case.

Size: 290 x 160 x 70)mm. Cat #: QM-1620 **$89.95**

For Bulk Buys Contact Our Wholesale Department On (02) 743-5222

YCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS

JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS

JAYCARS DISCONTINUED PRODUCT SELLOUT
MANY ITEMS BELOW COST!!!

Stock is limited, there may not be all items in all stores. If your nearest Jaycar Showroom has sold out of the item you want to purchase, you can phone **(02) 743 6144** and they will advise which stores had that particular product in stock at the beginning of the sale. You can also phone around yourself, or you can place an order with our Mail Order Department on **(02) 743 6144**, using a credit card and we will do the finding for you and send the goods (plus post and packing). For full specifications and descriptions on the products listed below check our 1993 catalogue. Be quick, stock is limited and won't last.

Cat #	Description	Was	Now
AC1676	2 way speaker switch	19.95	13.95
AA2026	Walkman headphones	8.95	4.95
AB3442	Audio transducer	1.75	1.00
AV6514	PL259 to PL259 video cable	3.95	1.00
CM2092	Black dome midrange	49.95	30.00
CW2109	Magnavox 8w 8" woofer	39.95	27.95
CW2110	Forte 8" woofer	27.95	17.95
CW2118	Magnavox 10w 10" woofer	46.95	30.00
CW2120	Forte 10" woofer	39.95	23.95
CW2125	Magnavox 12MV 12" woofer	129.95	89.95
CW2128	Forte 12" woofer	49.95	29.95
CE2320	6" twincone widerange	13.95	9.50
CE2322	8" 4 ohm twincone	9.95	6.95
CE2335	Jet 10" coax PA speaker	399.00	299.00
CS2410	Forte 8" speaker kit - mono	65.00	45.00
CS2412	Forte 10" speaker kit - mono	79.95	55.00
CS2414	Forte 12" speaker kit - mono	89.95	65.00
CS2480	12" 3 way speaker boxes	220.00	120.00
HB5946	Car accessory case	4.95	2.95
HG9903	Copper tape 0.1"	9.95	6.95
HG9957	Knife blade set	2.99	1.75
HG9959	Artwork film 8 x 11"	5.50	3.50
HG9983	Negative photo resist	8.95	5.95
HG9988	Scotchcal 8005 Black Alum	14.95	8.95
KA1556	Kit - ultrasonic move detect	34.95	19.95
KA1733	Kit cro adaptor / comp test	24.95	10.00
KA1735	Kit cro adaptor for monitors	159.50	99.50
KA1740	Kit - 240V power relay	55.00	35.00
KA1743	Kit - 1mHz pulse generator	89.50	59.50
KA1744	Kit audio sweeper	99.00	59.00
KM3065	RS-true-232-interface	27.95	14.95
KC5100	Kit talking voltmeter	42.95	17.50
KC5108	Kit 40w 12-240V inverter	99.00	59.00
KC5110	Kit 50 + 50w studio amplifier	299.00	229.00
KC5116	Kit video switcher	129.95	69.95
KC5117	Kit 15w 12-240V inverter	49.95	29.95
KC5118	Kit off hook phone timer	17.95	9.95
KC5127	Kit AM radio transmitter	26.95	16.95
KC5130	Kit alarm triggered camera	49.95	29.95
LR8820	Wireless RX/TX control	109.50	89.50
MF1036	PL18/20VA transformer	38.95	24.95
MF1039	PL24/20VA transformer	38.95	24.95
MM1515	600/600 ohm Telecom T/F	12.95	5.00
MM2003	1120 line T/F-PA	17.95	10.00
MM2015	T/former 35/0/35v 2.5A	84.95	50.00
MM2040	T/former 9, 15+15v 0VA	9.95	5.00
PP0822	D15 R/Angle PCB male	4.25	1.00
PS0826	D15 R/Angle PCB female	3.50	0.50
PP0861	D37 R/Angle PCB male	1.00	0.20
PL0879	IBM D25 to Centronics lead	14.95	5.00
PS0896	Centronics IDC panel socket	6.95	2.50
PB8830	100 hole mini breadboard	5.95	3.95
QM1015	19 range multimeter	27.50	20.00
QP2235	Continuity tester probe	8.95	3.95
QP2240	AC-DC probe tester 110-500v	9.95	4.95
QM7212	World time delux	26.95	12.00
QM7218	Travel clock alarm / calculator	19.95	12.95
RU6706	2500uf 80v RP electro	8.50	4.00
RU6747	2200uf 63v can RG	4.25	2.00
RU6752	6800uf 16v RG can	2.95	1.00
RU6763	2200uf 25v RP PC	2.75	1.00
ST0595	SPDT mom spring ret switch	1.95	0.50
SK0931	41 SPST 240v illum switch	2.95	1.00
SK0940	40 SPST 240v 10A switch	1.50	0.50
SK0965	53 DPDT 240v 10A switch	4.50	2.00
SL2624	41 green 240v rect bezel	1.20	0.50
SL2840	Garden path light & t/former	39.95	22.95
ST3812	228° thermal fuse	2.95	1.50
SY4082	30A solid state relay	29.95	15.00
SY4080	15A solid state relay	24.95	12.50
TS1436	Nimrod torch tip	12.95	5.00
TH1806	8 pin IC inserter	7.95	4.00
TH1810	18-20 pin IC inserter	9.95	5.00
TH1814	24-28 pin IC inserter	10.95	5.00
TH1816	36-40 IC inserter	11.50	5.00
TD2015	3 x 50mm slot screwdrivers	1.95	1.00
TD2016	4 x 75mm slot screwdrivers	2.40	1.25
TD2017	5 x 100mm slot screwdrivers	2.95	1.50
TD2018	6 x 100mm slot scredrivers	3.95	1.75
TD2024	2 x 100mm Philips screwdriver	3.95	1.75
WB1540	9 core multicore cable	1.25m	0.50m
WW4310	Kynar wire 3.5" black - 100pk	5.95	1.95
WW4312	Kynar wire 3.5" blue - 100pk	5.95	1.95
WW4314	Kynar wire 3.5" green - 100pk	5.95	1.95
XC0135	1-959 min countdown timer	12.95	6.95
XC0250	Pot plant moisture meter	6.95	4.95
XC2050	Fuel cutout solenoid	69.95	39.95
YT6042	US ext lead to bare end - 2.5m	2.95	1.00
YT6046	US ext lead - phone - 5m	6.95	3.95
YT6200	Cellular phone holder	39.95	22.95
ZR1130	BR100 diode	0.95	0.40
ZT2228	AS1461/BFQ10 J fet	19.95	7.95
ZT2330	ZN3645 transistor	0.65	0.20
ZC4022	4022 CMOS IC	1.95	0.20
ZS5243	74LS243 quad bus X/ceiver	2.95	0.20
ZS5352	74LS352 inverting LS153	1.50	0.10
ZZ8418	4116 - 200ns RAM	2.95	0.50
ZZ8450	2708 eprom	14.95	8.00
ZZ8500	Used 2716 eprom	3.95	2.00
ZZ8502	Used 27C256	2.95	2.00
ZK8810	8250-B UART	16.95	8.95
ZK8832	XR8832 prog time/count	4.25	1.00
ZK8842	UCN4202 motor drive	5.00	1.50
ZK8950	AD590 temp sensor	13.50	7.50

DON'T WASTE TIME - IF YOU WANT SOMETHING IN OUR DISCOUNTED LIST ACT NOW!!!

We've got to clean out some of our existing titles to make way for new ones. Save 25%. Limited quantities available.

Cat #	Description	Was	Now
BS0420	Build 80386 IBM & save a bundle	36.95	27.71
BS0740	IBM personal upgrade guide	39.95	29.96
BC1130	Radiation exposures book	19.95	14.96
BC1140	Cellular telephone users guide	9.95	7.46
BC1145	World of satelite TV book	34.95	26.21
BT1306	Enhanced sound	26.95	20.21
BT1316	Handbook of accoustics	42.95	32.21
BT1318	Enhanced MS-DOS batch programming	39.95	29.96
BT1326	Simple practical filter design	38.95	29.21
BT1328	Upgrading PC's made easy	52.95	39.71
BT1330	DOS - the pocket reference	21.95	16.46
BT1332	Build your own IBM PC	42.95	32.21
BT1336	Design and build power supply	29.95	22.46
BT1342	12v Bible for boats	29.95	22.46
BT1344	Bit mapped graphics	59.95	44.96
BT1346	Advanced batch file programming	65.95	49.46
BT1348	MS-DOS batch file programming	44.95	33.71
BT1350	Upgrade IBM compatible and save	44.95	33.71
BT1352	Encyclopedia elec circuit - volume 4	69.95	52.46
BT1354	DOS beyond 640k	49.95	37.46
BT1356	Complete book oscilloscopes	37.95	28.46
BT1362	Regulated power supplies	54.95	41.21
BT1366	Amplifier circuits encyclopedia	29.95	22.46
BT1372	PC's made easy	43.95	32.96
BM2110	MS-DOS/PC-DOS quick reference	12.95	9.71
BM2130	1-2-3 for Windows	14.95	11.21
BM2132	Word Perfect for Windows	14.95	11.21
BM2344	24 SCR projects	11.95	8.96
BM2416	Understanding digital - T/shooting	12.95	9.71
BM2420	Understand computer science appl.	12.95	9.71
BM2434	Fascinating IC projects	3.95	2.96
BM2442	Digital IC's	4.95	3.71
BM2451	Using semiconductor diodes	3.95	2.96
BM2452	Practical electronic games	3.95	2.96
BM2453	Learn by experiments CMOS IC's	4.95	3.71
BM2455	Practical electronic projects	3.95	2.96
BM2459	Using function generators & PLL's	7.95	5.96
BM2462	Practical electronic devices	3.95	2.96
BM2481	Build Earth station satellite TV	26.95	20.21
BC3010	Learn DOS in a day	24.95	18.71
BC3012	Desktop publishing with Word Perfect	24.95	18.71
BC3014	Learn Word Perfect in a day	24.95	18.71
BC3016	Learn Lotus 1-2-3 in a day	24.95	18.71
BC3018	Learn Microsoft Works in a day	24.95	18.71
BC3040	Beginners guide to DOS	18.95	14.21
BC3042	DOS secrets	18.95	14.21
BC3043	More DOS secrets	19.95	14.96
BC3044	How to buy & understand computers	18.95	14.21
BC3048	PC secrets	18.95	14.21
BW3500	Windows 3.1 secrets	85.00	63.75
BW3502	Official X'Tree MS-DOS/Windows	39.95	29.96
BM4556	Towers OP amp & linear selector	19.95	14.96
BM4558	Towers digital IC selector	14.95	11.21

*SEE OUR CATALOGUE FOR DETAILS.

SAVE 25% OFF ALL THESE BOOKS

AYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS

LECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JA
LECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JA

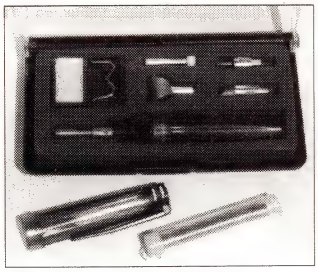
SAVE ON HOTSOL GAS SOLDERING IRONS

See catalogue for full details.
Standard HOTSOL with 2.4mm soldering tip

Cat. #: TS-1700 **was $38.95**
now $32.95 save $6.00

HOTSOL SERVICE KIT

This kit includes the same soldering iron as above, but comes with a range of accessories and it's all housed in its own case.
Includes:
•Hotsol butane gas tool •Protective cap •Non slip stand with sponge •Torch tip which gives a flame •2.4mm soldering tip •Hot blow tip for shrinking heatshrink tubing •Scoop for feeding tubing to hot blow tip •Hot knife tip •Roll of solder •Case which holds everything.



Cat. #: TS-1702 **was $64.95**
now $49.95 save $15.00

ELECTRONIC FET VOM SPECIAL

LOOK AT THE FEATURES:
•Full electronic operation (FET) •12A DC & AC current ranges •High input impedance •Polarity reversable switch •Safety test leads •Zero ohms adjust •Mirrored meter dial •Tilt stand •Fuse protected •Working indicator. For full specifications see catalogue.

Cat. #: QM-1050 **was $89.95**
now $69.95 save $20

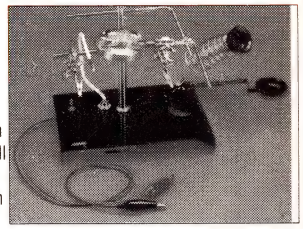
PHONE EXTENSION LEAD BARGAIN

This lead has a 15 metre length of telephone cable with a U.S. 4 pin plug on each end. Also supplied are two adaptors. One accepts the U.S. plug and converts it to an Australian plug. The other adaptor is from the U.S. plug to and Australian socket. So you can have any combination of U.S. plug to Aust plug, U.S. plug to U.S. plug or U.S. plug to Aust socket all 15 metres long. Adaptors cost $6.50 each and the lead is about $8. That's over $20 value.

Cat #: YT-6050

NEW **A BARGAIN AT $9.95**

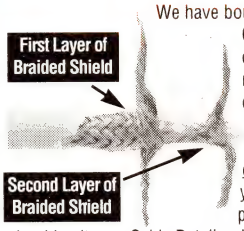
MULTI FUNCTION SOLDERING STAND



This soldering stand has got the lot. Its heavy steel base is 2mm thick, and incorporated in the base is:• a small reel of solder that mounts underneath • a battery holder for two AA batteries to power the light • a hole for the dish and sponge for tip cleaning.
Mounted at the back of the base is an adjustable pull out leg on which mounts the soldering iron stand. The solder dish and sponge can also be mounted on the left or right hand sides. There is also a small adjustable light for looking into those small dark crevices.

Cat. TS-1510 **$34.95**

SUPER QUALITY 75 OHM COAXIAL CABLE SPECIAL

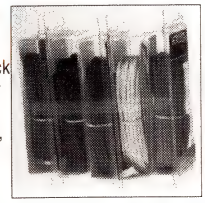


We have bought a quantity of Super High Quality double braided 75 ohm coax that was specially made for Telecom. The quality as you would expect with Telecom cabling is exemplory, excellent, and if you have a long run or RFI problem then this cable should suit you. Cable Details: •Impedance - 75Ω •Double braid shielded •O.D.- 6.0mm •Colour - Telecom yellow •Reel length - 250 metres. You would expect to pay over $2 per metre for cable of this quality, but if you act now we have a limited quantity available at a very reasonable price.

NEW

Cat. #: WB-2007 **Price/250m Roll $100**
Price/Metre $0.60

HOOK UP WIRE AUTO CABLE

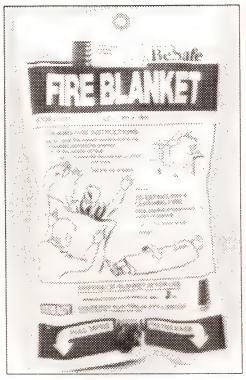


Don't miss this opportunity to stock up with quality cable at crazy crazy low prices. We've bought thousands of packs of Arista cable, and you can save a fortune. There are 3 different sizes on special and 5 colours of each size. All the cable is packaged in blister packs. They are available in large packs of one roll of each colour. One large pack for each cable size.

HUW7 Was $9.95 Now $5.95 Save $4
12 amp hook up wire. Size 19 x 0.36, OD 2.9mm, 14 gauge. Equivalent to our WH-3050 extra heavy duty hook up wire. Cat WH- 3050, 6 metres of each colour. Total length 30 metres, 5 colours. Arista price $29.75 Cat: WH-3021

HUW8 Was $9.95 Now $4.95 Save $5
15 amp auto cable. Size 19 x 0.45, OD 3.5mm, 12 gauge. This is equivalent to about 4mm auto cable. 3.6 metres of each colour. Total length 18 metres, 5 colours. Arista price $29.75 Cat: WH-3022

HUW9 Was $7.95 Now $3.95 Save $4
25 amp auto cable. This massive cable size 19 x 0.59, OD 4.4mm, 10 gauge. Suitable for the heaviest jobs. 2.4 metres each colour, 5 colours. Total length 12 metres. Arista price $29.75 Cat: WH-3023



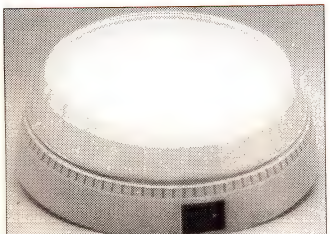
WHAT A FLOP!!! FIRE BLANKET

NEW

There has always been a lack of interest by the Public for safety problems. It started years ago when we purchased a large quantity of smoke detectors that no one else wanted to buy. This is another product that will save somebodys house or life, if there is one available when it is needed. Eveready thought they were a great idea and had them made to Australian Standard AS3504. The Fire Blanket measures 1.0 m x 0.9m and is made from a special fibreglass cloth. It can be used to suffocate a kitchen fire, car fire, clothing fire etc. They used to sell for just under $50.00. Nobody bought them. We have bought a quantity of them and can sell them for $9.95. At that price you owe it to yourself and your family to have one handy.

Cat. #: LA-5092 **$9.95**

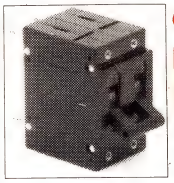
EVEREADY ANYWHERE LIGHT



Another surplus stock purchase. The anywhere light runs on two "D" size batteries and is ideal for use in closets, stairwells, attics, basements, camping, cars - anywhere where you need some light. It incorporates and on/off switch, and the light is from a torch globe. Size: 159(Dia) x 50 (Deep)mm. These used to sell for around $25.00. We have a limited quantity available for only $9.95.

NEW

Cat.#: ST-3035 **$9.95**



CIRCUIT BREAKER BARGAIN

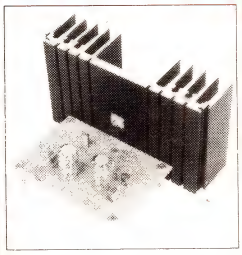
NEW

We've got a small quantity of US made Airpax brand magnetic circuit breakers. They are designed for equipment and appliance use, the breaker will trip instantly when 150% of the rated current is reached. Size: 63(H) x 38(W) x 70(D)mm. To buy normally these will cost over $100. 2 pole, 15 amp, 240 volt, 50/60Hz.

Cat.#: SF-2270
only $24.95

NEW KIT

LOW COST 25W AMPLIFIER MODULE KIT



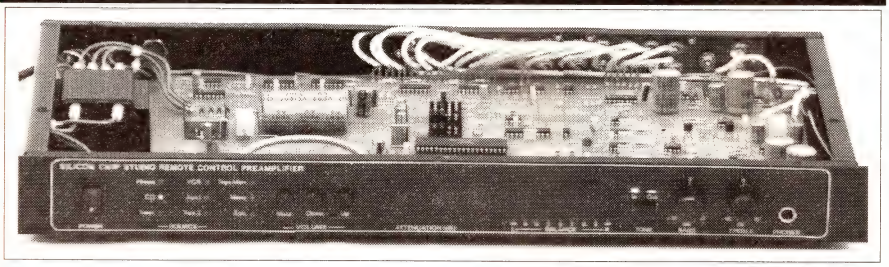
REF: SILICON CHIP DECEMBER 1993
This tiny module measures just 90 x 65mm, and delivers a genuine 25WRMS into 8 ohms. With a S/N ratio of 110dB and low distortion of 0.025%, this amp is ideal for Hi Fi use, or a replacement for an aging clunker. It is versatile due to its single rail or dual rail power supply option (kit supplied with components to suit either), its ease of construction due to one IC and only 13 other components. Kit supplied short form ie: PCB and electronic components only. External power supply components not included. Use heatsink HH-8592 $14.95

Cat. #: KC-5144 **$19.95**

YCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS J
YCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS J
YCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS J

JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS

REMOTE CONTROL PREAMP KIT



REF: SILICON CHIP SEP/OCT/NOV 1993
BUILD YOUR OWN HI-TECH REMOTE CONTROL HI FI PREAMP

EXCLUSIVE JAYCAR "BLUE PRINT" VERSION

Jaycar will of course be producing a standard version of this project. This version will include the fluorescent choke-type power transformer, nickel plated RCA sockets, Scotchcal panelling, carbon film resistors and standard screened cabling as well as the other parts specified in the projects part list. In addition to this, however, we will also be making available a fully Blueprinted kit which will include (but not limited to) the following features:

- low noise radiation toroid power transformer
- fully punched and screen printed front panel in distinctive "Blueprint" artwork
- gold plated RCA sockets throughout
- special low capacitance screened cabling
- machined pin IC socket for the microprocessor
- 1% metal film resistors instead of carbon types
- pre-programmed microprocessor *included* in the cost
- pre-wound chokes
- metal thread fixing screws fixing inserts clinched into chassis. Beware of cheap chassis' that use self tapping screws!!
- specially written step-by-step instructions
- remote control extra

NEW

STANDARD KIT

Includes all specified components except microprocessor and programming which must be obtained from Silicon Chip. No remote control.

Cat. # KC-5140 **$419.00**

BLUEPRINT KIT

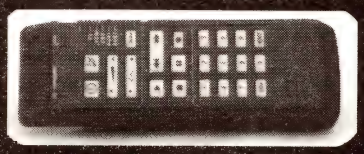
Kit as described including all the additional "Blueprint" features, including the pre-programmed microprocessor and without any remote control.

Cat. # KC-5142 **$449.00**

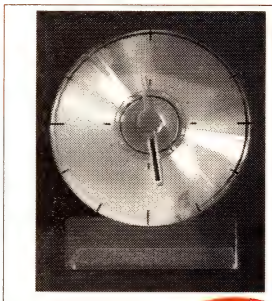
PRE-PROGRAMMED REMOTE CONTROL

As described elsewhere in this article.

Cat. # KC-5141 **$89.95**



CD DESK CLOCK



This great clock features a compact disc mounted on a small perspex stand. Ideal for desks, mantle-pieces, bedrooms, on top of the TV etc. Modern decor suits our modern living. Runs on 1 x AA battery. Ideal gift.

Cat. #: XC-0110 **$19.95**

NEW

DIGITAL TYRE GAUGE

For safetys sake you should keep an eye on your tyres air pressure. Many pressure gauges at service stations are inaccurate as they are constantly dropped by uncaring motorists. Keep one of these in your glovebox. It's easy to use and the pressure is easily read from the digital gauge. Features include: •touch button operation •detect speed 0.5 sec •unique, easy to handle pistol shape design •reading in PSI 10-50 •low battery consumption.

Cat. #: QM-7240 **$29.95**

NEW

ULTRASONIC CLEANERS REDUCED

NEW

Clean your jewellry, glasses, dentures, watches, relays, switches, connectors, PCB's, pens, cameras, filters etc. It uses a transducer to produce millions of activated microscopic cleansing bubbles which blow dirt, grease and grime off surfaces and deep into cracks and holes. New model has 4 timers - 4, 8, 12 & 16 minutes. 240VAC operation. Capacity 570ml. Cat. YH-5400

Was $199.00 Now Only $159.00 Save $40.00

PC CONTROLLED EPROM PROGRAMMER - KIT

NEW

Ref E.A. Sept 93.

This programmer is controlled via the parallel port on an IBM compatible PC. As well as programming EPROMs, it also has a readback feature. The hardware can handle EPROMs from 2716 (2k x 8) to 27256 (32k x 8). With modifications larger devices can be handled. It will also programme 2816 and 2864.

The kit includes 2 x PCBs, box, scotched panel, 2 x ZIF sockets and all specified components.

Cat. KA-1752 **ONLY $99.50**

MAGNAVOX 12W SENSATION LESS THAN HALF PRICE

We have purchased a quantity of the fabulous Magnavox 12W 12 inch speakers at a special price. This speaker is stocked by us and normally sells for $59.95. We have been able to slash the price to $29.95 a saving of $30.

Speaker Details

- Paper cone, foam roll surround, high temp 25mm voice coil
- 350g Barium magnet.
- Power handling:80WRMS.
- Freq range fo: 6000Hz,
- Sensitivity: 89.2dB/W/mt.
- Res. Frequency: 25.7Hz.
- QMS: 3.24 •QES: 1.12 •QTS: 0.83 •VAS: 362.1L.

Two box sizes - both sealed.

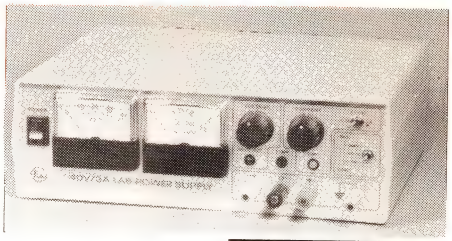
VOL (Litres)	50	100
Tuning Freq	73.8Hz	55.2Hz
Response Peak	6.01dB	4.13dB
-3dB Frequency	49.9Hz	38.6Hz
Qtc	1.93	1.52

Cat. CW-2122

Catalogue Price $59.95 Now Only $29.95

NEW KIT - NEW KIT - NEW KIT - NEW KIT

VERSATILE 40V/3A LAB POWER SUPPLY KIT



REF: Electronics Australia Dec/Jan 94

This new supply should handle all but the most specialised tasks on a home or professional workbench. It features full electrical and thermal overload protection, adjustable current limiting, dual panel meters, and can be used as either a single or dual-tracking supply. Specifications: •0 to 40V (0 to +/- 20V) •current up to 3.5 amp •load regulation better than 0.2% at 3A output •output ripple less than 5mV at 3A .

KIT AVAILABLE JANUARY

Kit is supplied complete with case, PCB, screened and punched panels plus all specified electronic components.

Cat. #: KA-1755 **$169.00**

BECOME A JAYCAR DEALER

Contact our Wholesale Dept. on (02) 743-5222

BUY IN BULK AND SAVE

JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS

ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JA

LOW COST DMM REDUCED EVEN FURTHER

Features: •3.5 digit 12.5mm LCD display •Transistor test •Diode test •10 amp current •Plug in leads. Full feature meter with plug in 4mm probes and transistor tester for under $30!!! This is the ideal first multimeter, and will give years of faithful service.
Cat. #: QM-1500

Was $34.95
Only $29.95

DOOR WATCHDOG

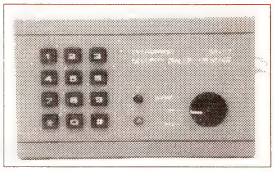
After the success of our Electronic Watchdog alarm, we have found a much cheaper door knob model. To use, simply place over the door knob on the inside and switch on. It's designed to be used on round type door knobs that are common in flats and newer homes. As soon as someone touches the door knob outside, the unit starts barking like a dog. It is an excellent deterent, and offers inexpensive piece of mind for our older community, and people alone.
Features include: •simple operation - switch on to use •adjustable volume control •loud barking dog sound alarm •electronic touch activated sensor •adjustable sound volume. Requires a 216 9 volt alkaline battery (Cat: SB-2395 $6.30).

Cat: LA-5282 **Only $24.95**

NEW

INSTALLERS Contact us for great prices

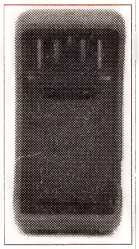
ALARM PANEL TELEPHONE DIALLER



This is a marvellous product which will connect to virtually any home -business alarm panel. It has a built-in microphone which records a 16 second message by you and then when the alarm is triggered will send the message up to four different numbers, or any combination of the same. Suitable for pulse or tone phone systems. Also suitable as an alerting system for the elderly or the sick. easy to connect to both alarm system (N/C terminals) & phone (2 wires). Requires 12VDC - from alarm panel.Stores 4 telephone numbers which can be easily sequenced. Not Austel Approved.

Cat: LA-5190 **Was $189 Now $159**

UNIVERSAL RUBBER HOLSTER FOR DMM'S



This quality holster suits our large digital multimeters. It will protect them from drops and general rough treatment. It includes a tilting bail and can be wall mounted. It will suit the following DMM's: TES 3.75 digit - Cat QM 1475, TES Frequency DMM-Cat QM1520, Dual Display DMM -Cat QM1525, Meters 4.5 digit DMM-Cat QM1460 plus other full size meters with height about 185mm and width approximately 85mm. Holster size: 200 x 99 x 55(D)mm.
Cat #: QM-1510

$19.95

NEW

Merry Christmas

BELLMATE 1000 ALARM PANEL SPECIAL

We're overstocked. We have taken $30 off the fabulous eight sector Bellmate Alarm Panel. Features: •8 programmable zones plus tamper and panic •silent alarm if desired •4 tamper systems •split zone inputs •1 or 2 triggered inputs •handover zone prog. •remote available. See catalogue for full specifications. Requires backup battery - 1.2Ah Cat. # SB-2480 $28.50, 6.5Ah Cat.# SB-2486 $43.50. 240VAC power supply Cat. # MP-3021 $24.50.
Cat. #: LA-5324

Normally $229
Now $199

Cat. LA-5016
$49.95

BELLMATE 100 - PULSE COUNT PASSIVE INFRA RED

Specifications:
- 24 element zones in 3 layers
- Wide angle 90° coverage
- Coverage 15 x 15 metres
- Operating voltage 9 - 16V DC
- Relay output - N.C. contacts
- Tamper proof - 22Ω resistor with short circuit protection
- Max rating 1A resistive/24V DC
- Size 110(H) x 70(W) x 55(D)mm
- Current draw 20mA
- Tamper switch for 24 hour zone
- Pulse count switch, normal or 3 pulse
- Sensitivity adjustment
- Sliding PC board
- N.C. terminals
- 2 year warranty

COMPUTER DISKS

YOU WON'T BUY CHEAPER!

Lifetime Guarantee, white box.

5.25" DSDD	Cat. XC-4730/Pkt 10	$4.50
5.25" DSHD	Cat. XC-4732/Pkt 10	$8.50
3.25" DSDD	Cat. XC-4736/Pkt 10	$8.50
3.25" DSHD	Cat. XC-4738/Pkt 10	$12.95

IBM FORMATTED

5.25" DSHD	Cat. XC-4733/Pkt 10	$9.95
3.25" DSHD	Cat. XC-4739/Pkt 10	$14.95

AA NICAD BATTERIES

700mAh with solder tags - Cat. #: SB2451
$3.75 each

500mAh rechargable - Cat. #: SB-2452
4 for $10.00

500mAh with solder tags - Cat. #: SB2453
$2.95 each

700mAh rechargable - Cat. #: SB2450
$3.50 ea or 4 for $12.50

THE LATEST KITS FROM JAYCAR

PC Controlled Eprom Prog	KA-1752	$99.50	18/36W Fluro Inverter	KC-5143	$79.95
Decoder For ACS Signals	KA-1753	$18.95	5v to 12v Convertor	KC-5137	$24.95
Noise And Distortion Meter	KA-1751	$139.50	In Circuit Transistor Checker	KC-5136	$14.95
1GHz Frequency Counter	KA-1750	$149.50	Colour Video Fader	KC-5135	$29.95
50mHz Frequency Counter	KA-1749	$89.50	Digital Voltmeter	KC-5134	$32.95
DSO Adaptor For PC's	KA-1748	$85.00	Woofer Stopper	KC-5133	$49.50
Courtesy Light Timer	KC-5138	$14.95	Nicad Cell Discharger	KC-5132	$27.95
Jumbo Digital Clock	KC-5139	$109.00	LED Audio Power Meter	KC-5131	$24.95
Hi Fi Preamp	KC-5140	$419.00	Alarm Triggered Camera	KC-5130	$49.95
Remote Control For Preamp	KC-5141	$89.95	Camcorder Mixer	KC-5129	$29.95
"Blueprint" Hi Fi Preamp	KC-5142	$449.00	Low Fuel Indicator	KC-5128	$11.95

BARGAIN PRICED TELEPHONE LEADS

US TELEPHONE LEADS

Used from wall socket to telephone

US PLUG TO US PLUG - $2.95
- Length - 10 feet (3 metres)
- Flat cable. Ivory colour. Cat. # YT-6080

US PLUG TO US PLUG - $8.95
- Length - 50 feet (16 metres)
- Flat cable. Ivory colour. Cat. # YT-6081

US PLUG TO US PLUG - $2.95
- Length - 7 feet (2 metres)
- Curly cable. Black col. Cat. # YT-6082

US PLUG TO US PLUG - $6.95
- Length - 25 feet (8 metres)
- Curly cable. Black col. Cat. # YT-6083

US EXTENSION LEADS

US PLUG TO SOCKET - $3.95
- Length - 7feet (2 metres)
- Flat cable. Ivory colour. Cat. # YT-6084

US PLUG TO SOCKET - $6.95
- Length - 25 feet (8 metres)
- Flat cable. Ivory colour. Cat. # YT-6085

US PLUG TO SOCKET - $8.95
- Length - 50 feet (16 metres)
Flat cable. Ivory colour. Cat. # YT-6086

PLUGS, ADAPTORS, SOCKETS

US TELEPHONE PLUG - RJ12 - 6x4
Norm. $3.50 Now $2.00
- Pkt 5. Cat. # PP-1432

ADAPTOR - US SOCKET TO SOCKET
Norm. $4.95 Now $2.95
- Cat. #: YT-6060

US SURFACE MOUNT SOCKET - Only $1.95
- Fawn in Colour. Size: 55x49x21(D)mm socket on end. Cat. # YT-6059

US WALL SOCKET - Only $1.95
- Size: 76(W)x120(H)x10(D)mm.
- Cat. # YT-6057

We have purchased a quantity of telephone leads and accessories at distressed prices, and have passed the savings on. Save up to 50%. Note: These are not Austel approved.

YCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JA

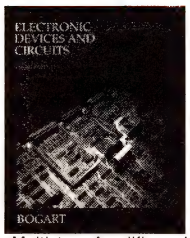
CAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRON
CAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRON
CAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRON

NEW BOOKS - NEW BOOKS - NEW BOOKS - NEW BOOKS - NEW BOOKS

SEE PREVIOUS ADS FOR FULL DETAILS

MS-DOS Commands	BM-2134	$14.95
Microsoft Quick Pascal	BM-2136	$14.95
Substitution & Data For TV/Video	BM-4550	$14.95
Windows 3.1 Secrets	BW-3500	$85.00
Official X'Tree	BW-3502	$39.95
Fix Your Own PC	BW-3506	$54.95
Learn Microsoft Word For Windows Now	BM-2138	$29.95
Learn Microsoft Excel For Windows Now	BM-2140	$29.95
Virtual Reality Playhouse	BW-3504	$47.95
12 volt Doctors Alternator Book	BB-3800	$32.95
12 Volt Doctors Practical Handbook For The Boats Electrical System	BB-3804	$39.95
12 Volt Doctors Project Book	BB-3802	$22.95
Learn Microsoft Word Now	BM-2142	$19.95
The Nortons Utilities	BM-2128	$7.95
Supercharging MS-DOS	BM-2144	$12.95
Learn Autocad 12 In A Day	BC-3024	$29.95

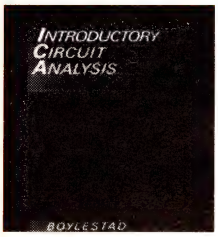
ELEC. DEVICES AND CIRCUITS



3RD EDITION
This quality hardcover book is a modern, thorough course in electronic device theory. A knowledge in DC circuit anaysis and some AC circuit theory will help the reader. The chapters in this book are: •Introduction •Semiconductor Theory •Diodes As A Circuit Element •Bipolar Junction Transistors •Small Signal BJT Amplifiers •Bias Design In IC's •FETs •FET Circuits and Applications •Handy Parameters •Frequency Response •Multistage Amplifiers •Integrated Differential in OP Amp Circuits •OP Amp Theory •Application of OP Amps •Power Amplifiers •Power Supplies & Voltage regulators •Special Elec Devices •DA & AD Convertors •Appendix - Spice & PSpice.
988 pages - Hardcover - 190 x 240mm.
Cat. BX-3900 **JUST $56.95**

NEW

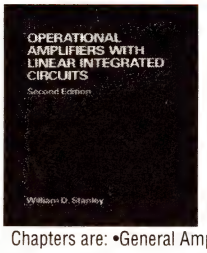
INTROD. CIRCUIT ANALYSIS



7TH EDITION
Another quality hard cover edition. An ideal textbook for those who want to learn electronics. Chapters include: •Introduction, Current and Voltage •Resistance, •Ohms Law •Power and Energy •Series Circuits •Parallel Circuits •Series - Parallel Networks •Methods of Analysis and Selected Topics •Network Theorems •Capacitors •Magnetic Circuits •Inductors •Sinusoidal Alternating Waveforms •Basic Elements and Phasors •Series and Parallel AC Circuits and Networks •Power (AC) •Resonance, Decibells - Filters and Bode Pilots •Pulse Waveforms & the R-C Response •Polyphase Systems •Npn-Sinusoidal Circuits •X'formers, System Analysis - An Introduction. 1,114 pages - hardcover - 260 x 210mm.
Cat. BX-3904 **JUST $57.95**

NEW

OP AMPS WITH LINEAR IC'S



2ND EDITION
This hardcover book wil teach you: •To establish methods for analyzing , modelling, and predicting OP amp performance •To develop the readers ability in designing circuits to perform specific operations •To acquaint the reader with common circuits and enable them to select available devices.
Ideal for those interested in engineering technology, students, design engineers, technicians and advanced hobbyists.
Chapters are: •General Amplification Concepts •Ideal OP Amp Analysis and Design •OP Amp AC and DC Effects and Limitations •Linear OP Amp Circuits •Comparators •Oscillators and Waveform Generators •Active Filters •Rectifier Diode and Power Circuits •AD and DA Conversion •Misc Circuits.
Hardcover - 240 x 190mm.
Cat. BX-3902 **JUST $46.95**

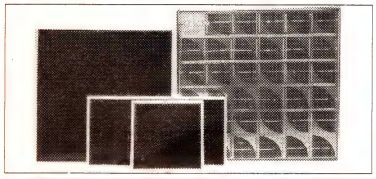
NEW

TURN YOUR SURPLUS STOCK INTO CASH!!!
Jaycar will purchase your surplus stocks of components & equipment.
Call Mark Harris or Bruce Routley NOW on (02) 743-5222

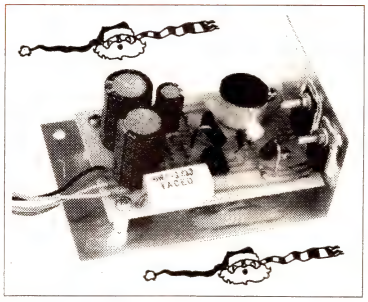
SOLAR PANELS

1 watt	6 volt	Cat. #: ZM-9020	**$24.95**
2 watt	12 volt	Cat. #: ZM-9024	**$44.95**
4 watt	12 volt	Cat. #: ZM-9026	**$79.95**
8 watt	12 volt	Cat. #: ZM-9030	**$149.95**

See catalogue for full details.



SOLAR BATTERY CHARGER KIT



REF: Silicon Chip Nov 91
Will hadle solar panels up to 25 watts and 2 amps. Kit includes PCB, pot cores, heatsink and all specified components.
Cat. #: KC-5102
$34.95

8 INCH SUBWOOFER

As used in subwoofer project in Electronics Australia June 1992. The cabinet utilises a bandpass design whereby the speaker is mounted in a partition in the cabinet, the front compartment being 14 litres and the rear 38 litres. The speaker features a massive magnet assembly, 80W RMS power handling, butyl rubber cone suspension and a super rigid frame. Copies of the project are available for viewing at Jaycar stores.

Rated Power	80 watts rms
Frequency Response	35 - 5kHz
Sensitivity	90dB - 1W/1m
Voice Coil Impedance	8Ω @ 400Hz

WARRANTY 1 YEAR

Cat. #: CW-2150 **only $99.50**

Merry Christmas Merry Christmas Merry Christmas Merry Christmas Merry Christmas Merry Christmas Merry Christmas

Jaycar ELECTRONICS

HEAD OFFICE
6 Leeds Street Rhodes 2138
Telephone (02) 743 5222
FAX (02) 743 2066

POST & PACKING

$10 - $24.99	$ 3.75
$25 - $49.99	$ 4.50
$50 - $99.99	$ 6.50
OVER $100	$ 8.00

MAIL ORDERS
P.O. Box 185 Concord 2137
ROAD FREIGHT ANYWHERE IN AUSTRALIA (up to 20kg) $14.00

MAIL ORDER VIA
FREE CALL - ORDERS ONLY
(008) 022 888
HOTLINE (02) 743 6144

MasterCard. VISA AMERICAN EXPRESS Cards Welcome

ADELAIDE SA 194 Wright St (Cnr. Selby St) (08) 231 7355
Mon-Fri 9 - 5.30 Fri 8.30 - Sat 9 - 12pm

BURANDA QLD 144 Logan Rd (07) 393 0777
Mon-Fri 9 - 5.30 Thurs 8.30 - Sat 9 - 4pm

COBURG VIC 266 Sydney Rd (03) 384 1811
Mon-Fri 9 - 5.30 Fri 8.30 - Sat 9 - 4pm

MELBOURNE CITY Shop 2, 45 A'Beckett St City (03) 663 2030
Mon-Fri 9 - 5.30 Fri 8.30 - Sat 9 - 2 Sun 10 - 4pm

SPRINGVALE VIC 887-889 Springvale Rd Mulgrave (03) 547 1022
Nr Cnr. Dandenong Rd Mon-Fri 9-5.30 Fri 8.30 - Sat 9 - 2

SYDNEY - CITY 129 York St. (02) 267 1614
Mon-Fri 8.30 - 5.30 Thurs 8.30pm - Sat 9 - 4pm

BANKSTOWN 363 Hume Hwy Cnr Meredith St (02) 709 2822
Mon-Fri 9 - 5.30 Thurs 8.30pm - Sat 9 - 4 - Sun 10 - 4pm

GORE HILL 188 Pacific Hwy (Cnr. Bellevue Ave) (02) 439 4799
Mon-Fri 9 - 5.30 Thurs 8.30 - Sat 9 - 4pm Sun 10 - 4pm

PARRAMATTA 355 Church St (Cnr. Victoria Rd) (02) 683 3377
Mon-Fri 9 - 5.30 Thurs 8.30pm Sat 9 - 4pm Sunday 10am - 4pm

PENRITH 199 High St (047) 21 8337
Mon-Fri 9-5.30 Thurs 8.30 - Sat 9-4pm Sun 10-4pm

RHODES 6 Leeds St (02) 743 5222
Mon-Fri 9 - 5.30

CAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JA
CAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JA
CAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JA

Lesson 3

Programming the Motorola 68HC705C8 microcontroller

In Lesson 2, we covered the following topics: (1) Mnemonics; (2) Addressing Modes; and (3) the 6805 Instruction Set. This month, we look further at addressing modes.

By BARRY ROZEMA

TABLE 1

Op-Code	Mnemonic	A. Mode	No. Bytes	No. Cycles
A6	LDA	IMM	2	2
C6	LDA	EXT	3	4
83	SWI	INH	1	10
C7	STA	EXT	3	5
CC	JMP	EXT	3	3
43	COMA	INH	1	3
A3	CPX	IMM	2	2
42	MUL	INH	1	11

Before moving into new territory, let's first take a look at the answers to the exercises in Lesson 2.

Exercise 1: fill in the blank spaces in Table 2 (Lesson 2). A look at the instruction set in Lesson 2 and/or the op code map on page 30 of the Motorola MC68HC705C8 technical summary (BR594/D) should have given you the information to get the results shown in Table 1.

You should also have modified your programs in last months lesson to get the following results. Each exercise is a modification of the previous program. You add the same instructions on to the program with a change to the data. The flow charts have the new or modified processes shown with an asterisk (*).

Exercise 2: rewrite the flow chart and the program to make the LEDs give a smooth inward pattern; ie, to make the LEDs close in one bit at a time instead of two.

To do this, you will need to examine the bit pattern to get the hex values. Table 2 shows the bit map.

Notice that the bits come "on" one bit at a time in an inward direction. The asterisks show the data that's added to give a smoother display pattern. Table 3 shows the modified program.

Better visual effect

Exercise 3: experiment with the time delay to give a better visual effect.

TABLE 2

B7	B6	B5	B4	B3	B2	B1	B0	HEX	
0	0	0	0	0	0	0	0	$00	
1	0	0	0	0	0	0	1	$81	*
1	1	0	0	0	0	1	1	$C3	
1	1	1	0	0	1	1	1	$E7	*
1	1	1	1	1	1	1	1	$FF	

To do this, you need to change the immediate byte that sets the time delay. Remember, the time delay uses a subroutine that is in the MAL-4 monitor ROM. There are seven time delay subroutines and each one is set by loading the accumulator before jumping to the subroutine.

You may have found that experimenting with various delay values by changing the immediate byte in the LDA #$?? instruction quickly became rather tedious. A better way is to make the delay time adjustable while the program is running. To do this, you load the accumulator with the value of the input port instead of a fixed value; ie, you use extended addressing instead of immediate. The PORT A input port address is $0000.

The instruction looks like this: LDA $$0000.

The modified process is shown with an asterisk in the flow chart of Fig.2 and Table 4 shows the modified program. Note: remember to enable PORT A by turning switch 7 of DIP SW2 (Bit 6) on.

Kitt scanner

Exercise 4: rewrite the flow chart and the program to make an 8-bit "Kitt" scanner; ie, one LED on at a time switching from left to right and back again.

This program will need to produce a display with a pattern like the one in the bit map of Table 5. If you make the time delay adjustable as in exercise 3, the program will repeat the following instructions.

```
A6  xx     LDA  #$xx
C7  00 01  STA  $$0001
C6  00 00  LDA  $$0000
CD  14 D9  JSR  $$14D9
```

The xx will contain the pattern data. There are 14 patterns to be displayed before the program starts again. The

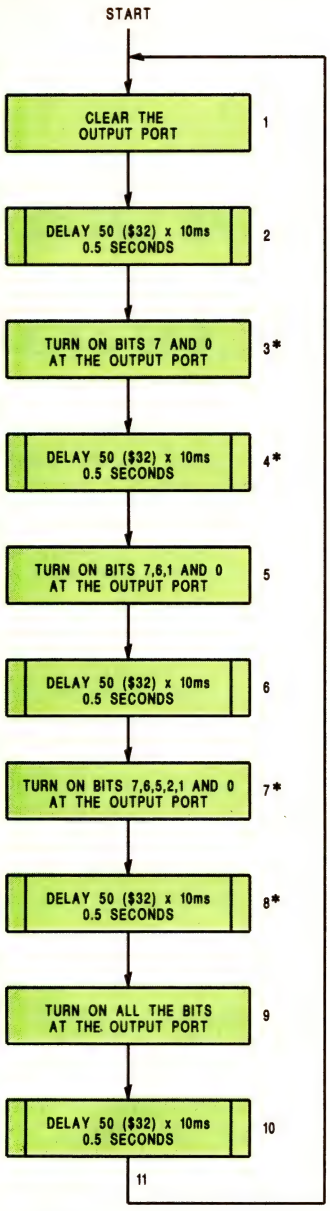

START
CLEAR THE OUTPUT PORT
1
DELAY 50 ($32) x 10ms 0.5 SECONDS
2
TURN ON BITS 7 AND 0 AT THE OUTPUT PORT
3*
DELAY 50 ($32) x 10ms 0.5 SECONDS
4*
TURN ON BITS 7,6,1 AND 0 AT THE OUTPUT PORT
5
DELAY 50 ($32) x 10ms 0.5 SECONDS
6
TURN ON BITS 7,6,5,2,1 AND 0 AT THE OUTPUT PORT
7*
DELAY 50 ($32) x 10ms 0.5 SECONDS
8*
TURN ON ALL THE BITS AT THE OUTPUT PORT
9
DELAY 50 ($32) x 10ms 0.5 SECONDS
10
11

Fig.1: the flow chart for Exercise 2. The program first turns on the two outside LEDs at the output port, then turns the remaining LEDs on to give a smooth inward pattern; ie, the LEDs close in one bit at a time.

program will take 14 x 11 bytes = 154 bytes plus two jumps (one jump to go back to the start and one to jump to the RAM at location $0100). The last jump is needed because the MAL-4 only has 144 bytes of user RAM at page zero ($0030 - $00BF) – see the memory map in the November 1993 issue of SILICON CHIP.

Addressing modes

In Lesson 2, we covered the following three addressing modes: Inherent, Immediate and Extended. This lesson, we will introduce another ad-

TABLE 3

ADDRESS	CODE	LABEL	MNEMONIC	OPERAND	COMMENT
0030	A600	START	LDA	#$00	Clear accumulator & store at output
0032	C70001		STA	$$0001	
0035	A632		LDA	#$32	Set time delay 50 ($32) x ACC = 0.5 seconds
0037	CD14D9		JSR	$$14D9	
003A	A681		LDA	#$81	Load accumulator & store at output
003C	C70001		STA	$$0001	
003F	A632		LDA	#$32	Set time delay 50 ($32) x ACC = 0.5 seconds
0041	CD14D9		JSR	$$14D9	
0044	A6C3		LDA	#$C3	Load accumulator & store at output
0046	C70001		STA	$$0001	
0049	A632		LDA	#$32	Set time delay 50 ($32) x ACC = 0.5 seconds
004B	CD14D9		JSR	$$14D9	
003E	A6E7		LDA	#$E7	Load accumulator & store at output
0050	C70001		STA	$$0001	
0053	A632		LDA	#$32	Set time delay 50 ($32) x ACC = 0.5 seconds
0055	CD14D9		JSR	$$14D9	
0058	A6FF		LDA	#$FF	Load accumulator & store at output
005A	C70001		STA	$$0001	
005D	A632		LDA	#$32	Set time delay 50 ($32) x ACC = 0.5 seconds
005F	CD14D9		JSR	$$14D9	
0062	CC0030		JMP	$$0030	Jump to start

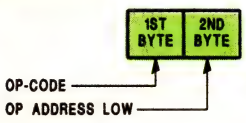
TABLE 4

ADDRESS	CODE	LABEL	MNEMONIC	OPERAND	COMMENT
0030	A600	START	LDA	#$00	Clear accumulator & store at output
0032	C70001		STA	$$0001	
0035	C60000		LDA	$$0000	Set time delay input port A times ACC
0038	CD14D9		JSR	$$14D9	
003B	A681		LDA	#$81	Load accumulator & store at output
003D	C70001		STA	$$0001	
0040	C60000		LDA	$$0000	Set time delay input port A times ACC
0043	CD14D9		JSR	$$14D9	
0046	A6C3		LDA	#$C3	Load accumulator & store at output
0048	C70001		STA	$$0001	
004B	C60000		LDA	$$0000	Set time delay input port A times ACC
004E	CD14D9		JSR	$$14D9	
0051	A6E7		LDA	#$E7	Load accumulator & store at output
0053	C70001		STA	$$0001	
0056	C60000		LDA	$$0000	Set time delay input port A times ACC
0059	CD14D9		JSR	$$14D9	
005C	A6FF		LDA	#$FF	Load accumulator & store at output
005E	C70001		STA	$$0001	
0061	C60000		LDA	$$0000	Set time delay input port A times ACC
0064	CD14D9		JSR	$$14D9	
0067	CC0030		JMP	$$0030	Jump to start

TABLE 5								
B7	B6	B5	B4	B3	B2	B1	B0	HEX
0	0	0	0	0	0	0	1	$01
0	0	0	0	0	0	1	0	$02
0	0	0	0	0	1	0	0	$04
0	0	0	0	1	0	0	0	$08
0	0	0	1	0	0	0	0	$10
0	0	1	0	0	0	0	0	$20
0	1	0	0	0	0	0	0	$40
1	0	0	0	0	0	0	0	$80
0	1	0	0	0	0	0	0	$40
0	0	1	0	0	0	0	0	$20
0	0	0	1	0	0	0	0	$10
0	0	0	0	1	0	0	0	$08
0	0	0	0	0	1	0	0	$04
0	0	0	0	0	0	1	0	$02

dressing mode called "Direct" or "Zero Page".

Direct Addressing Mode



Symbol for Direct addressing: $ or Z or none.

The CPU requires two bytes of data to process this instruction. The first byte is the op-code, while the second byte is the Low address of the operand in memory. This is like the extended addressing mode except that you can only address zero page.

The CPU sets the High address to $00 and so you can only address data from $0000 to $00FF. The CPU requires the operand (byte) which is "directly" at zero page in memory. The memory location for this byte is known at the time the program is written. The op-code for direct addressing is found in Lesson 2, Table 1, column 5. In these lessons, we will use the "Z" symbol to indicate Direct addressing (Z for Zero page). The mnemonics will have a "Z" tacked on the end of them, eg: ADDZ, ANDZ, ORAZ, EORZ, LDAZ, STAZ and LDXZ.

The MAL-4 can make good use of zero page (Direct) addressing. Most of the user RAM is located at zero page, as are all of the input/output, timer, watchdog and other control registers. Thus, it is possible to write programs that use more direct (zero page) addressing than extended. This saves one byte of program each time you use direct instead of extended addressing.

The program in Table 6 is the same as in Table 3 from Lesson 2 except that direct addressing was used instead of extended addressing, were possible. The four asterisks (*) in Table 6 indicate instructions with direct (zero page) addressing. The first three (STAZ $01) are used because the output port (PORT B) is at address $0001 which is in zero page of memory. The last instruction (JMPZ $30) is used because our program is written in zero page RAM, from $0030.

Running the program

Load the program into the MAL-4 and run it from location $0030. The output port LEDs should flash in the pattern described in Lesson 2. If not, go back and check that the program has been entered correctly. If there are problems, Mode 2 (the disassemble mode) may help you find your mistake.

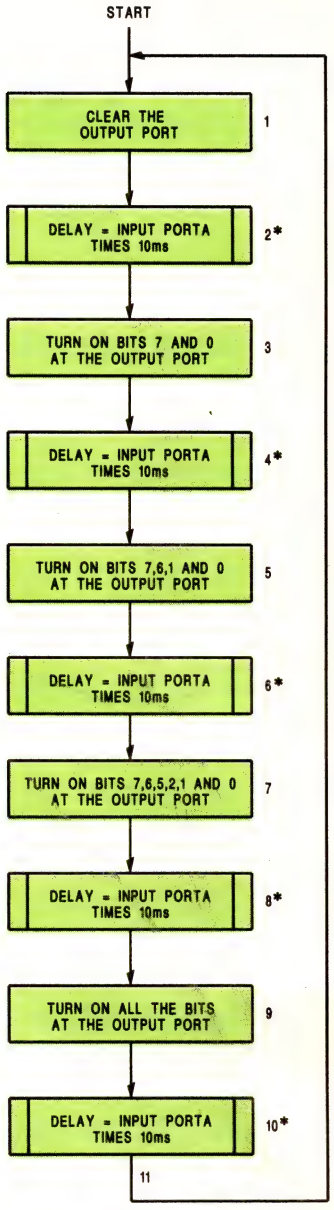


Fig.2: this modified flow chart will provide a better visual effect than the flow chart shown in Fig.1. In this case, the time delays have been set by loading the accumulator with the value of the input port instead of a fixed value.

Things to do

In Lesson 4, we will continue with addressing modes and we will explain relative addressing. Make sure that you read up on 8-bit 2's complement negative numbers. Finally, rewrite all your programs in Exercises 2-4 to use direct addressing were possible. Note the saving on memory. **SC**

TABLE 6					
ADDRESS	CODE	LABEL	MNEMONIC	OPERAND	COMMENT
0030	A600	START	LDA	#$00	Clear accumulator & store at output
0032	B701	*	STAZ	$01	
0034	A632		LDA	#$32	Set time delay 50 ($32) x ACC = 0.5 seconds
0036	CD14D9		JSR	$$14D9	
0039	A6C3		LDA	#$C3	Load accumulator & store at output
003B	B700	*	STAZ	$01	
003D	A632		LDA	#$32	Set time delay 50 ($32) x ACC = 0.5 seconds
003F	CD14D9		JSR	$$14D9	
0042	A6FF		LDA	#$FF	Load accumulator & store at output
0044	B700	*	STAZ	$01	
0046	A632		LDA	#$32	Set time delay 50 ($32) x ACC = 0.5 seconds
0048	CD14D9		JSR	$$14D9	
004B	BC30	*	JMPZ	$30	Jump to start

SERVICEMAN'S LOG

Whingeing Willie & the bouncing TV

What does one do when a set bounces? Much depends on why it has bounced but there is also the customer's reaction to consider. Most customers are understanding & reasonable – even apologetic. But every so often ...

Yes, every so often one strikes a stinker and this is about one such customer. But first, why do sets bounce? Broadly, there are two categories. The one we all dread is the one which, strictly speaking, is our own fault.

The scenario is typical: an intermittent fault with erratic behaviour, resulting in a long and involved process of trial and error to track it down. Usually, this involves re-making suspect joints, running the set through hot and cold cycles, and replacing the most likely components, based on previous experience, measurements and a certain amount of gut feeling.

Nothing works at first but, eventually, one particular effort seems to be the answer; the set runs for days, or even weeks, without so much as a hint of trouble. So back it goes to the customer.

A week later – or even sooner – it is back in the shop, with the customer complaining that it is just as bad as ever. The customer's approach will vary. If they have been warned as to such a possibility – and I make it a point to do this – they will usually accept the situation philosophically, or even apologetically. A few will be more upset, but mostly at the device rather than the serviceman.

In any case, one can only start over again, and write off the extra time to experience – the only good point being that many suspect components have already been eliminated. And, with persistence, the real culprit will eventually be found.

The other bounce

The other kind of bounce is quite different and typically involves a dead set with a routine fault that's easily recognised. The faulty component is replaced, any minor adjustments attended to, and the set goes back to the customer – another job completed.

Except that, a week later or so, it's back in the workshop – dead again. It's a completely different fault, of course, and it is not the serviceman's fault, but one can hardly blame the customer for not always appreciating this point.

But again, most customers will accept a truthful explanation, if it is carefully presented. And I normally waive any further labour charge in the interest of goodwill. But, as I said at the beginning, once in a while one strikes a stinker.

This story started with a phone ca from a stranger. He opened the cor versation by asking whether I prc vided warranty service for Samsun sets. I said "yes" and asked what wa the nature of the problem. It was quit simple as he described it; the picture had crept down from the top and up from the bottom ever so slightly, revealing "...a little black line".

So I said, "OK, bring it in and we'll have a look at it". And so it duly turned up at the shop, along with the various sales dockets which I had asked him to bring along, to substantiate the warranty claim. The set turned out to be a model CB-3325J, fitted with a P/58SC chassis. I turned it on while he was there and, yes, his description was quite accurate; a very marginal degree of vertical underscan.

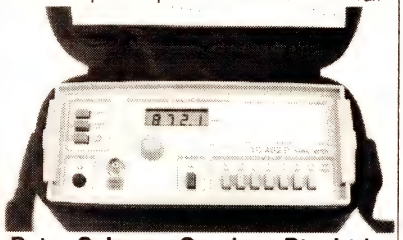
I told him it looked as though it needed nothing more than a small adjustment and suggested that he leave it with me for an hour or so. I would have to remove the back of the set and I wanted time to confirm that the fault was a simple as it looked.

As it transpired, he had other things to do, so he suggested that he leave it with me and call back in a couple of days. Well, that was fine by me; it would mean that I could fit it in with other jobs more conveniently and also allow me to soak test it for a couple of days. So everyone was happy.

I also took advantage of the extra time to run the set for several hours before I touched it. And it simply performed as it had when first switched on; there was no change of any kind.

Why work in the dark

A new **SADELTA TC402D** signal meter could answer all your TV reception problems. $799.+20% Tax



Peter C. Lacey Services Pty. Ltd.
80 Dandenong Rd. FRANKSTON 3199
Tel:(03) 783 2388 Fax:(03) 783 5767 ACN006893438

ubsequently, I pulled the back off, et the height control and looked for ything else that was obviously ong, but found nothing. I then re-ced the back and ran the set daily til the customer returned. It ran rfectly during all that time.

When he returned, I filled out the cessary warranty claim, demon-rated the set to him, and sent him on s way. And, as usual, one tends to entally write off such jobs almost mediately; there are other jobs to o.

he balloon goes up

But a couple of weeks later the bal-oon went up. The customer was on ne phone in a most belligerent man-ner. His complaint now was that the picture had shrunk drastically; it was now only about 10cm high in the cen-re of the screen. But more to the point, ne was accusing me of not having fixed the set in the first place.

I pointed out that there was no "fix-ing" involved in the first call; it was a simple adjustment. His reply was that I should have seen that this was going to happen, to which I testily replied that my crystal ball had been a mite cloudy that day. At a more practical level, I advised him to bring the set back in. It was still under warranty and it would cost him nothing to have it fixed.

And so the set landed back on the bench and the owner went on his way muttering all kinds of nasty things about Samsung, yours truly, and the industry in general. I let him rave; I had the more important job ahead of finding the fault.

I wasn't expecting it to be a particularly difficult job but, as I have mentioned in these notes before, Samsung circuits and manuals are disturbingly short on voltages and waveforms. In some cases, the only voltages given are the rail voltages and this is something which can cause a lot of wasted time.

One important point I noted about the fault was that there was no suggestion of non-linearity; it was a simple loss of amplitude only. Such a clue could be valuable in nominating the most likely fault areas, or in interpreting CRO patterns.

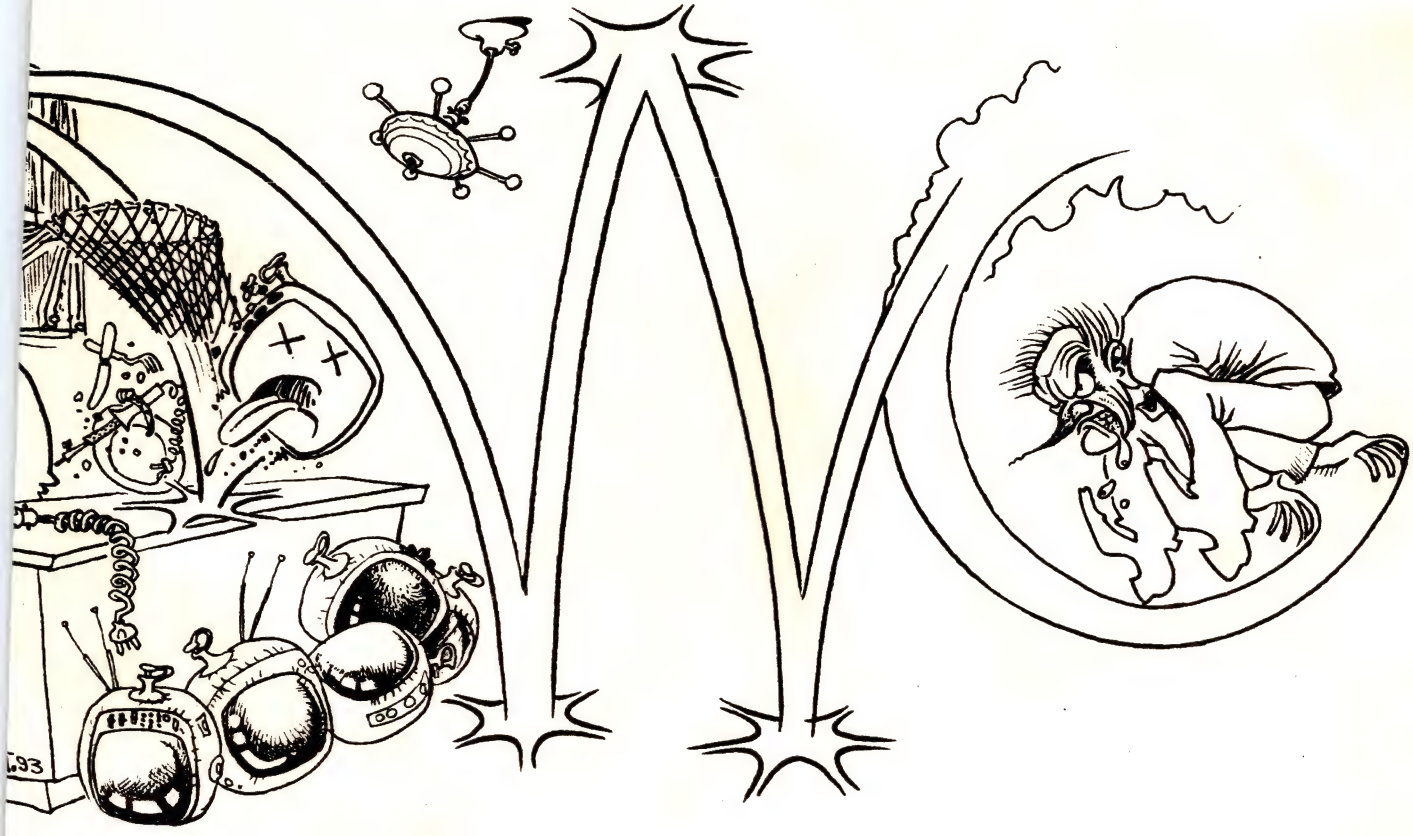
I began by making a preliminary check around IC301 (KA2131), a 9-pin vertical output IC – see Fig.1. My first check was at pin 4, the supply rail pin. This connects to the 25V rail via diode D302 and it checked OK. From here, I went to the height control, VR301 (1kΩ) and simply tried varying it. I wasn't really surprised when it had only a marginal effect.

Jungle chip

My next stop was IC101, a 28-pin jungle chip which, among other things, contains the vertical oscillator, horizontal oscillator and the sync separator. I spent some time here with the CRO, particularly around pins 3 and 4. Pin 3 carries the vertical drive signals for IC301, entering that IC on pin 6. Pin 4 takes feedback signals from the output circuitry of IC301.

Well, there were waveforms at all these points and most of them seemed to have reasonable shape but, without any reference, I was flying blind in regard to amplitude. However, I was somewhat suspicious of the oscillator amplitude (or vertical drive voltage) on pin 3. It did seem a bit light on.

This thought lead me to pin 2, which is the supply rail for what is labelled the "Ramp Gen" but is really the vertical oscillator. This pin is connected to



AND SO THE SET LANDED BACK ON THE BENCH...

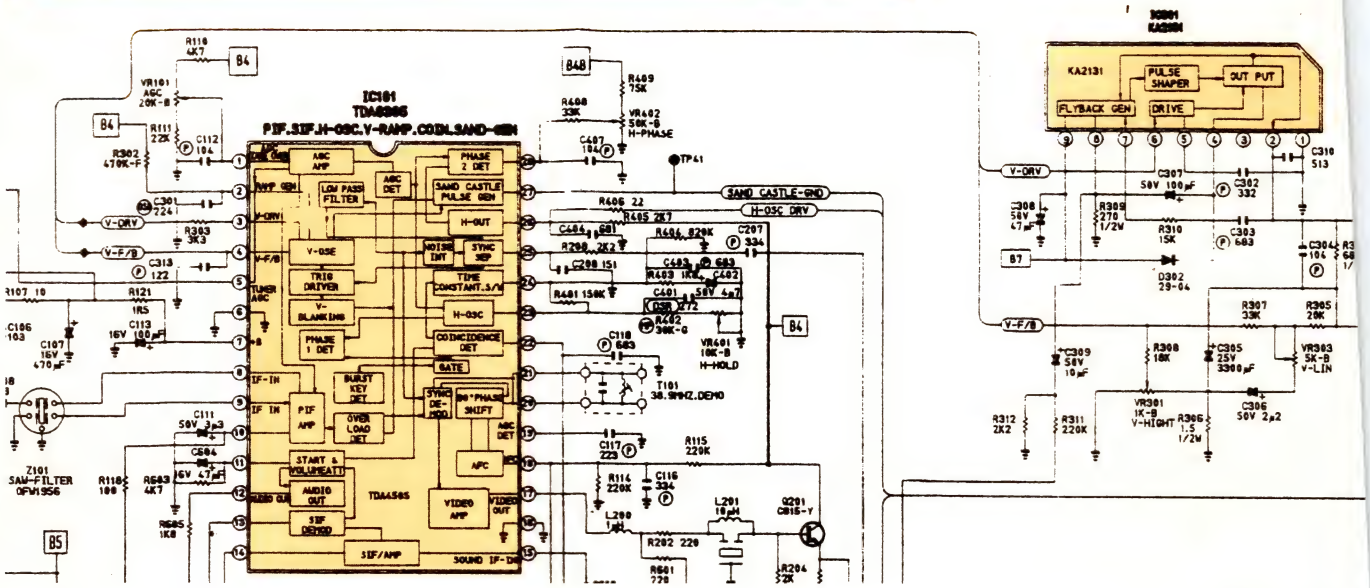


Fig.1: this diagram shows the jungle IC (IC101) & the vertical output IC (IC301 at top right) in the Samsung CB-3325J colour TV set.

the 12V rail via a 470kΩ ¼W resistor (R302). And this was the culprit; it had gone high.

It was routine from there on. I fitted a new resistor, reset the height control, checked everything over once again, and gave it a soak test for several days. I also took the opportunity to make a complete voltage check around these two ICs, and other important points, and filed them with the manual. I then called the customer and told him it was ready.

He called in the next day, signed the warranty claim, and went on his way grumbling and mumbling, mainly along the lines that the set was "no so-and-so good" etc, etc. I didn't bite; I was only too happy to see the back of him and I hoped that it would be for good.

Alas, it was not to be. Would you believe that he was back on the phone again barely a week later? His complaint was legitimate enough – the set was now completely dead. Privately, I wondered what I had done to deserve such bad luck. Of all the customers they could have picked, the gods had to pick Whingeing Willie.

OK, so he did have a gripe. But what really annoyed me was that he was now quite abusive at a personal level – as if the failure was my fault. And customer or not, I made this point quite strongly. The failure was not my fault; odd components can fail at any time and it was just unfortunate that there had been two such failures in quick succession. Such a coincidence was rare but it was not the first time it had happened.

And I went on to state the situation as I had before; the set was still under warranty, he could bring it in at any time, I would give it priority, and it would cost him nothing.

So he duly turned up with the set and continued his tirade of abuse. But I wasn't prepared to take it lying down and took the opportunity to have my say. I repeated the point that the failure was not my fault, emphasising that it is virtually impossible to predict when a particular component is going to fail. On a percentage basis, component failure rates are remarkably low – and have improved amazingly in recent years – but the day of zero failure is a still long way off.

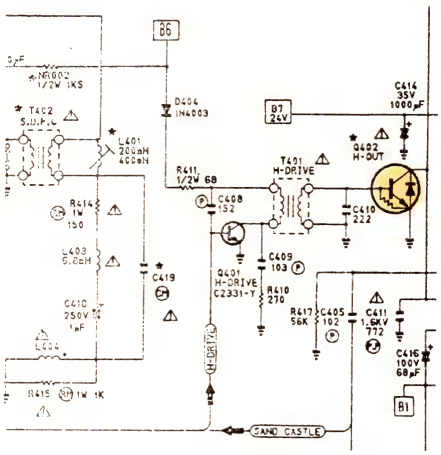


Fig.2: the horizontal output stage in the Samsung CB-3325J. It failed when IC101 shut-down due to some other fault.

That is one of the reasons why manufacturers provide warranty cover. And in this case the warranty service had been close at hand, he had not had to resort to a commercial carrier, and the job had been done in the shortest possible time. In view of this, I told him that he didn't really have much to complain about.

I doubt that I really convinced him but it quietened him down somewhat. Anyway, he went off, still in something of a high dudgeon but with a silencer now fitted.

And so I turned to the more practical problem of finding this new fault. It wasn't very hard really, although there was a side effect. It soon became apparent that IC101 was again involved, since it now appeared to be completely inoperative. This lead me to the supply pin (pin 7) which is supposed to be at +12V. Only there wasn't any voltage on it. The culprit was resistor R121, a 1.5Ω resistor, apparently part of a decoupling network. It was open circuit.

A new resistor soon had the set up and running again but it was still not quite right. It was now suffering from significant horizontal underscan. I was

d I had caught that before Whinging llie had had a chance to see it; he'd ve had a seizure on the spot.

Again, it didn't take long to find the lprit. It was another resistor, this ne R411 (68Ω). This resistor supies current from the 16V rail to the llector of the horizontal driver transtor (Q401) via the primary of the orizontal drive transformer (T401) – ee Fig.2. It had gone high by just nough to affect the drive.

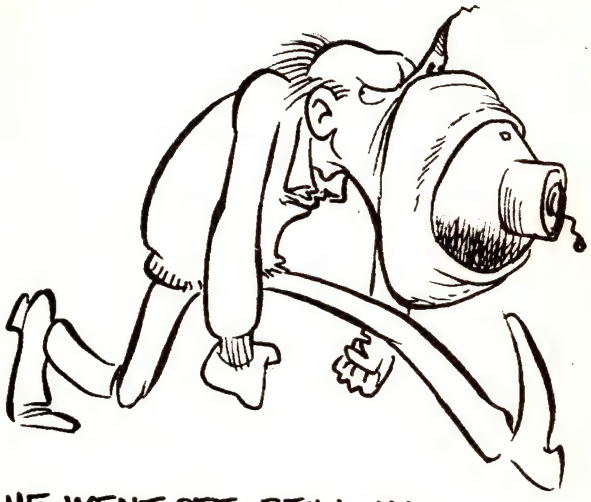
But it wasn't really the resistor's ault. Deprived of drive from IC101, Q401 would have been drawing excessive current and R411 would have been well on the way to complete failure.

Anyway, it was easily fixed. I went over the set again, made sure all adjustments were optimised, tried to visualise what else might go wrong, and finally pronounced the job finished. I made out the warranty claim and rang the customer.

He wasn't any happier when he called this time. He continued his abuse of both Samsung in general and myself in particular. Among other things, he declared his temptation to "...go and wrap the set around Mr Samsung's ears".

I told him I didn't think that would do him any good and I think this made him realise just how ridiculous the suggestion was. And I had the last word – I reminded him again that he had been given first class service, with no argument, at no cost, and a minimum of waiting time. What more did he expect?

At that he went on his way and that, thankfully, was the last I saw of him. It all happened many months ago and I am hopeful that this happy state will continue. I don't want his custom again.



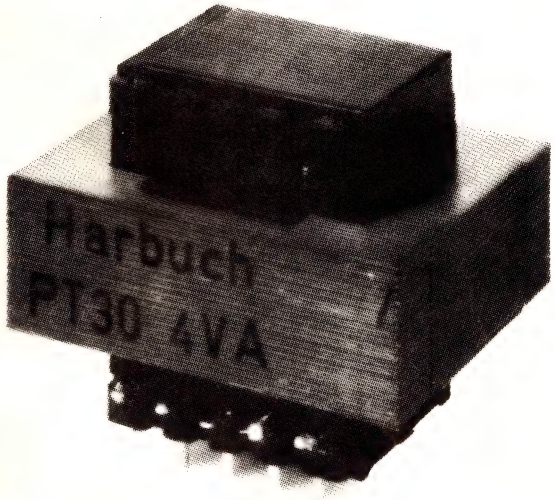
Customer ignorance

But the incident did make me think. Although this was an extreme case, customer dissatisfaction along these lines is nothing new; it has been cropping up from time to time for as long as I can remember.

So why does it happen? Basically, it is due to customer ignorance, although the industry itself may be at least partly responsible.

More exactly, this ignorance is in the form of two fundamental misconceptions. The first is that the serviceman, by some magical process, is able

PCB POWER TRANSFORMERS



Proudly manufactured in Australia by
HARBUCH ELECTRONICS Pty Ltd
9/40 Leighton Pl, Hornsby NSW 2077
Ph:(02)476 5854 (02)482 7241 Fax:(02)476 3231

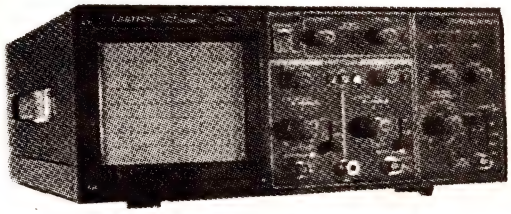
VISA bankcard MasterCard

20MHz Dual Trace Cro
by LABTECH

12 months warranty

★ Bandwidth: DC-20Mhz.
★ Rise Time: 17.5nSec.
★ Sensitivity: 5mV to 20V/DIV.
★ Accuracy: +/- 3%.
★ Sweep Time: 0.2us to0.5 Sec/DIV.
★ Sweep Modes: AUTO, NORM.

was $699.00 plus probes



NOW $650.00 ! and if you act fast, cut out this ad and we'll include two (2) 1:1 10:1 probes for nothing. *Now that's value !*

Mailorders Welcome - $15.00 p+p

David Reid Electronics
ACN: 001 372 372 Pty. Ltd.
127 York St, SYDNEY 2000
PO Box Q103, SYDNEY 2000
Phone: (02) 267 1385
Fax: (02) 261 8905

VARYING CUSTOMER APPROACH: PHILOSOPHICAL, APOLOGETIC, UPSET..

to test – or even look at – any component and predict it's end-of-life point.

The second misconception arises out of the first. It assumes that because such predictions are possible, a competent serviceman will check all components in the device being serviced and replace all those which are about to "wear out". And this "wear" concept is another part of the misconception; the idea that all parts will eventually wear out. I won't dwell on the impracticality of testing every component in a set; suffice it to say that the mind boggles!

So the message we have to try to put across is that very few modern components have a predictable life. Valves did and picture tubes still do but most others have a theoretically infinite life. When they fail, it is usually a catastrophic failure which can happen at any time.

And, of course, it is quite impractical to test all the components in a set. Does the customer have any idea how many there are? In most cases, the part would have to be removed for testing and then replaced. Quite apart from anything else, this could easily create more faults than it would prevent and it would really amount to a virtual rebuilding of the set. Would the customer be prepared to pay for such an exercise? Of course not.

Having written all that, I am forced to concede how seemingly impossible the task would be. Nevertheless, I think we should keep these misconceptions in mind and, whenever the opportunity is favourable, do our best to gently nudge the customer's thinking in the right direction. Who knows; we might score once in a while.

J. L.'s routine faults

But enough of the philosophising; its time to get back to the bench – J. L.'s bench, that is, where we left him last month running through some typical routine faults. More precisely, he had just solved an acute case of the warbles in a Sharp audio cassette deck. He goes on.

The next job on the bench was another audio cassette tape deck, this time an Hitachi model. A note taped to the top of the cabinet said that the machine had been "wowing" for some time but had now stopped altogether.

I soon had the cover off and began a close inspection of the works. There was nothing wrong with the power supply or the electronics. It seemed to me that this had to be another mechanical problem.

In fact, when I turned the power on, I noticed that the capstan flywheel made a short movement in the direction of normal rotation but then sprang back to its original position. It was obviously being jammed by some very elastic medium.

I examined the cassette well, half believing that it was another pinch roller, like the last job. It wasn't but it was another perished rubber part. This time it was the main drive belt. This is a flat belt, about 5mm wide. It had softened and stuck to the motor pulley. When the motor started, it stretched the belt and wound several layers around the pulley.

The belt was a write off, so I had to remove the motor and its mounting plate, fit a new belt, then reassemble the motor and test the unit. It wasn't quite as easy as it sounds, since the remains of the old belt were very difficult to remove from the motor pulley. I had to use copious quantities of spirit to soften the deposit, then scrape and wipe until it was all gone.

Following these two audio jobs, it is back to colour television for another brief exercise. This was a 50cm Philips set fitted with a KT2A-2 chassis. The owner reported that the on/off switch must be broken because the set would not switch on.

I don't know why customers always blame the power switch when a set won't start. There are a hundred other things that could be blamed but it's the power switch that cops all the flak! (It's obvious J. L.; when they press the switch nothing happens – so the switch must be at fault!)

On this occasion, I was soon able to absolve the switch simply by putting my ohmmeter across the active and neutral pins on the power plug. The meter showed infinity when the switch was off and a hundred or so ohms with the switch closed.

Next, I went to the power supply section on the horizontal output board. The supply configuration in this set is most unusual. It's effectively two separate DC supplies, connected in series by a Triac that's triggered by a variable pulse derived from one of the bridge rectifiers.

It's a funny arrangement and one that is not at all easy to service if any part of it breaks down. In this case, I was lucky; I found the cause of the trouble after only 10 minutes' work.

I established that there were correct voltages being supplied from the bridges but very little at the output. So it seemed reasonable to assume that the regulator was at fault and my usual practice is to test transistors and diodes first.

I was only a few minutes into the testing when I noticed a dry joint at one of the regulator transistors attached to a large heatsink. It didn't look bad enough to be totally open circuit but it was and a touch with the iron soon restored the set to working order. So much for a "faulty" power switch!

The last job for the day was a General Electric portable colour TV set, said to have an intermittent colour problem. The problem was intermittent but not in the usual sense of the word.

When first switched on, the set would come up with a good black and white picture. Then, after anywhere from 30 seconds to five minutes later, the colour would snap on and stay that way as long as the set was left untouched. Switching off or changing channels would lead to a repeat of the black and white process.

The fault was easy to diagnose. It was caused by maladjustment of the sub-carrier oscillator. The oscillator was tending to run off-frequency and the AFC circuit was having difficulty pulling it back. The service manual gives details of the adjustments required and it took only a minute or two to effect a complete cure.

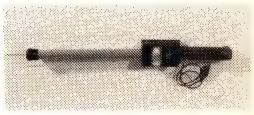
The adjustment calls for the AFC circuit to be disabled so that the colour can be "floated" by tuning the oscillator. As the adjustment is made, the colours run first one way then the other. The correct setting is between the two runs, where the colour just stands still. When the AFC is re-enabled, the picture should be in colour and should stay that way. In this case, it did and the set went home to a happy customer.

After that, it was time for me to go home. Not every day is as straightforward as this one. But then, if I didn't get an occasional day free from the bad jobs, I'd go stark raving mad. **SC**

AUSTRALIAN MADE TV TEST EQUIPMENT

12 Months Warranty on Parts & Labour

HIGH-VOLTAGE PROBE



Built-in meter reads positive or negative 0-50kV. For checking EHT & focus as well as many other high tension voltages. **$120.00 + $5.00 p&p**

DEGAUSSING WAND

Great for computer monitors. Strong magnetic field. Double insulated, momentary switch operation. Demagnetises colour picture tubes, colour computer monitors, poker machines & amusement machines. **$85.00 + $10.00 p&p**

TV, VCR TUNER REPAIRS

From $22. Repair or exchange plus p&p

Cheque, Money Order, Visa, Bankcard or Mastercard

J.V.TUNERS **Phone for free product list**

216 Canterbury Rd, Revesby, NSW 2212, Australia.

Phone (02) 774 1154 Fax (02) 774 1154

D & K WILSON ELECTRONICS

Have you found those components yet?
We know that it can be difficult, frustrating and a waste of your valuable time.
So why haven't you contacted us?
We specialise in hunting down and locating components – old, obsolete, leading edge, normally available but now scarce due to allocation by overseas manufacturers.
Integrated circuits, resistors, capacitors, transistors, diodes, valves, varistors, etc.
Any brands
Let us save your valuable time
Contact us now on 833 1342
We are also distributors for Electrolube - lubricants and chemicals
Hakko - desoldering & soldering irons; SMD tools; replacement parts
NTE - replacements semiconductors

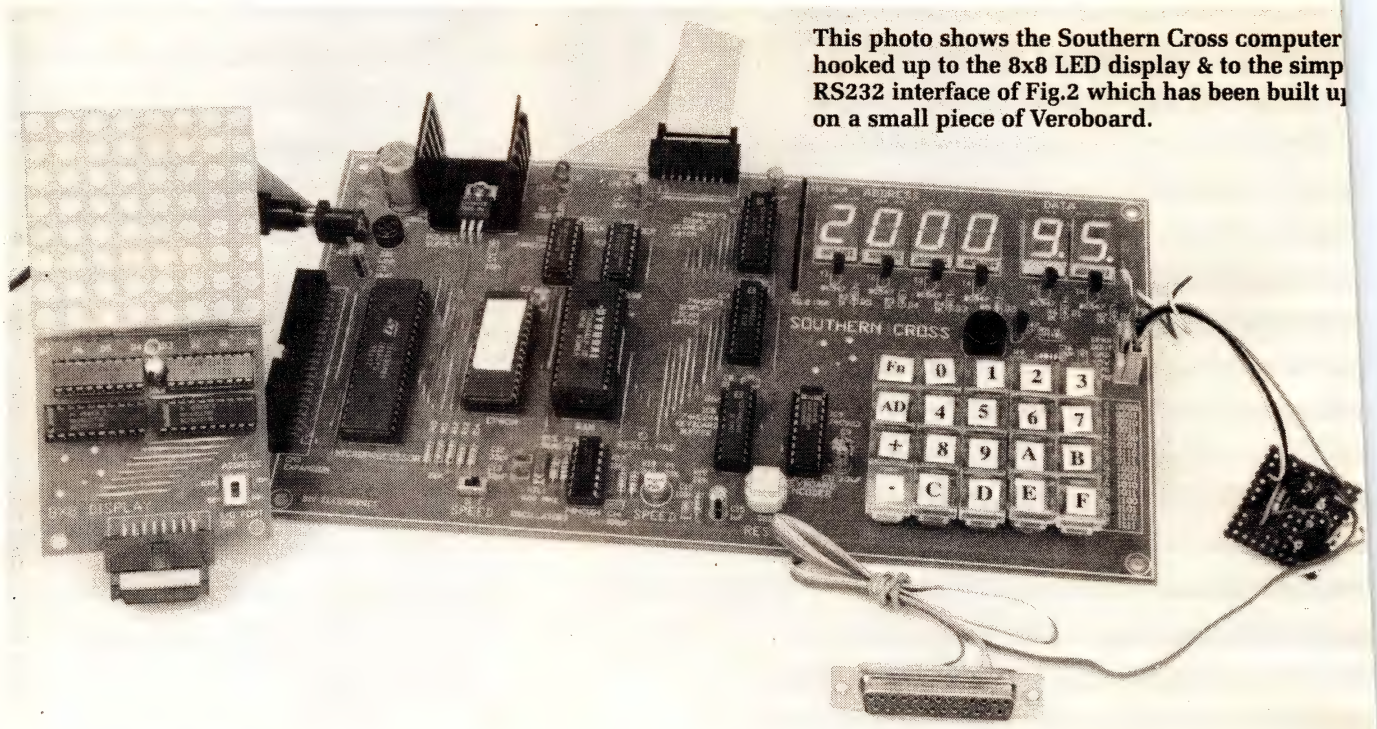
2/87a Queen St, St Marys, NSW 2760.
Phone (02) 833 1342 Fax (02) 673 4212

VIDEO & TV

SERVICE PERSONNEL
TV & VIDEO FAULT LIBRARIES

AVAILABLE AS PRINTED MANUALS $90 EACH + $10 DELIVERY
BOTH MANUALS VIDEO & TV $155 + $15 DELIVERY
OR AS A PROGRAM FOR IBM COMPATIBLES $155 + $10 DELIVERY

FOR MORE INFORMATION
CONTACT
TECHNICAL APPLICATIONS FAX / PHONE (07) 378 1064
PO BOX 137 KENMORE 4069



This photo shows the Southern Cross computer hooked up to the 8x8 LED display & to the simp RS232 interface of Fig.2 which has been built u on a small piece of Veroboard.

Peripherals for the Southern Cross Z80 computer

This month, we present a number of peripherals for the Southern Cross Z80 computer which was featured in the August 1993 issue of SILICON CHIP. We look at ways to connect the Southern Cross to a personal computer to make it easy to write programs, introduce an 8x8 LED Matrix display board which can produce interesting visual messages & describe an EPROM emulator.

By PETER CROWCROFT & CRAIG JONES

While it is desirable to learn how to enter machine code using the hex keypad of the Southern Cross computer, it is much easier to write these programs on a personal computer and then download them for testing.

The fast way to write such programs is to use a text editor on a PC and then use a Z80 assembler to produce a file suitable for downloading to the Southern Cross. A public domain Z80 assembler, Z8T, is supplied with the Southern Cross kit and produces what is called an Intel hex output file. This is an ASCII file with a checksum every 16 data bytes and other information to help ensure that the transmission can be checked by software at the receiving system.

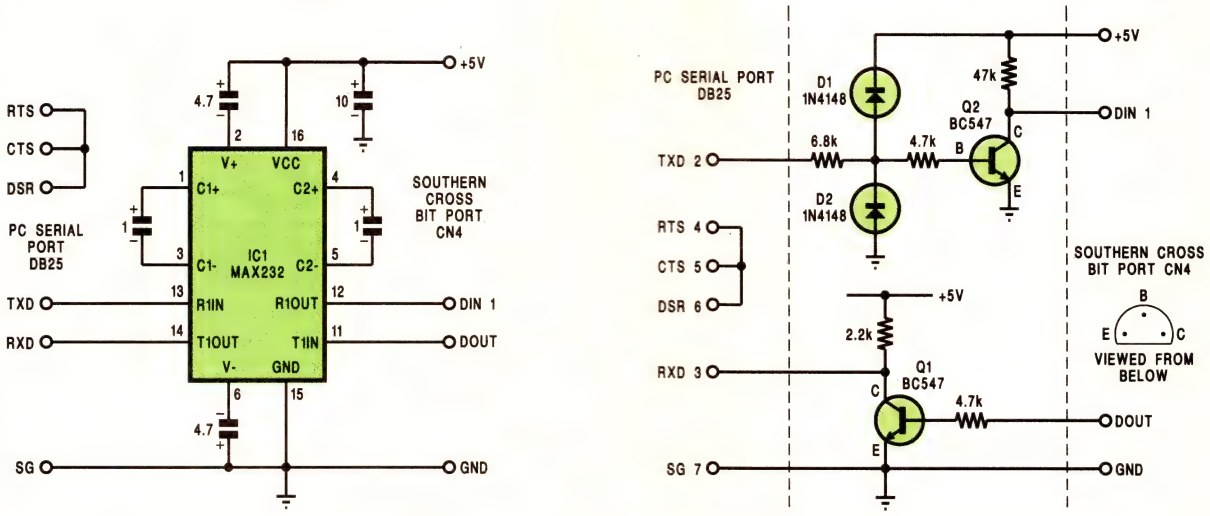


Fig.1 at left is the ideal circuit for an RS-232 serial interface as the MAX232 IC is designed for this job. However, most RS-232 applications for an RS-232 interface for the Southern Cross will be satisfied by the transistor circuit of Fig.2 (right).

There are basically two ways to connect the Southern Cross to a PC. First, you can connect it to the serial or parallel port of a PC and download the assembled program from the PC into the RAM space (2000H to 3FFFH). Second, you can use an EPROM emulator. In this case, the assembled program is moved to the emulated ROM space (2000H to 3FFFH.) The Monitor uses almost 4K of ROM so there is 4K free for you to use for your own programs.

Serial downloading

Assuming that you have written a program on your PC and have created an Intel hex file using the Z80 assembler, you will then want to download the hex file to the start of RAM (2000H) on the Southern Cross.

By the way, making the jump from a raw novice to being able to write such programs will probably take several weeks at least, assuming that you can devote plenty of time to your Southern Cross, once you have it up and running. We certainly do not make light of this achievement but we feel sure that most people who purchase the Southern Cross will do it.

The serial port on the Southern Cross is on connector CN4. Unfortunately, this cannot be connected directly to the PC serial port, since it operates on 12V while the Southern Cross operates at 5V. An interface board is required and two such interface circuits are shown in Figs. 1 & 2 – see above.

For reliable serial communications, the guaranteed way is shown in Fig.1, using a MAX232 IC. A much simpler circuit is shown in Fig.2. This should be adequate in most cases but cannot be guaranteed for all situations. It can be assembled onto a small piece of Veroboard. Three wires are required between the PC and the interface board, while four wires extend from the interface to the Southern Cross.

To download the file we must do two things: prepare the Southern Cross to receive the file and then get the PC to send the file. On the Southern Cross go to the address you want to put the file and press Function 1. The Southern Cross is now in 'ready to receive Intel Hex file' mode. To send the file from the PC you should first make sure that its serial port is not already being used by a mouse or other hardware item. Next you must set up the port with the DOS command:

MODE COM1: 4800,N,8,1

This sets the PC's port to 4800 baud to match that for the Southern Cross which is set to 4800 baud in the Monitor. Then enter the DOS command

COPY filename.hex com1:

This starts the file transfer. Alternatively, you could use a communications program, if you have one.

When the Intel hex file is fed to the Southern Cross, the Monitor checks that it has been received correctly and converts it into machine code in the correct memory locations. If the transfer was successful a 'C' is displayed. Press any key to return to the Monitor. The downloaded file should be in RAM at the address (usually 2000H) it was sent to. If an error has occurred an 'E' will be displayed. If it did not come down at all, then nothing will be displayed.

The baud rate for file transfer may be changed in software as outlined in the user manual supplied with the Southern Cross.

8 x 8 LED display

This add-on board allows you make your own moving message displays. One or two display boards may be

Parts List for the 8x8 LED Display

1 PC board, 108 x 60mm
1 CMD-58813 8x8 LED display
2 74HC273 octal D flipflops (IC1, IC2)
1 UDN2981 cathode driver (IC3)
1 ULN2803A anode driver (IC4)
1 DPDT slide switch (S1)
1 10µF electrolytic capacitor
2 18-pin IC sockets
2 20-pin IC sockets
1 16-pin box header connector
1 16-pin IDC socket connector
1 500mm length of 16-strand flat cable

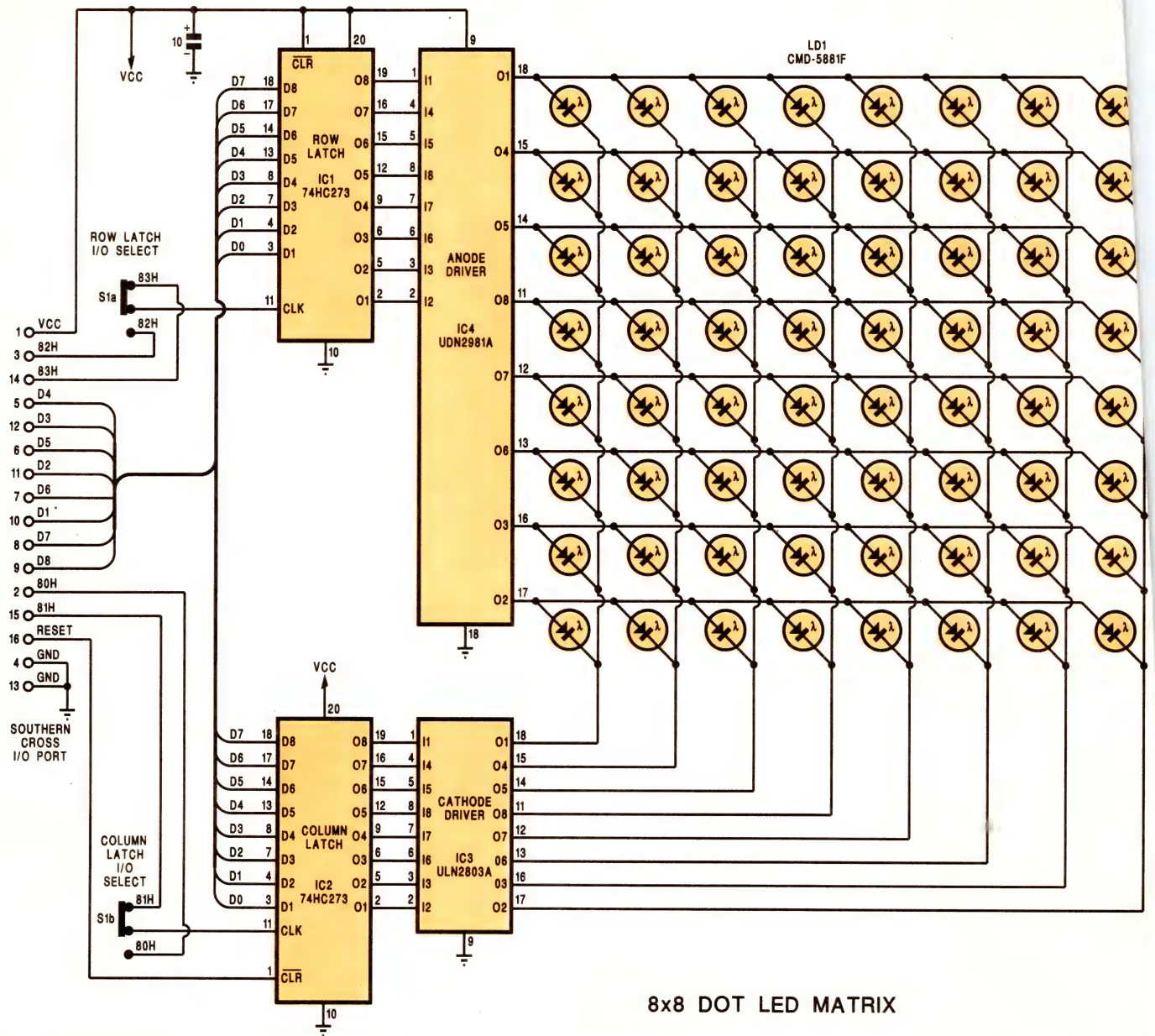


Fig.3: the 8x8 LED matrix display is driven from the parallel port of the Southern Cross computer via two Tri-state latch ICs (IC1 & IC2) & two buffer ICs (IC3 & IC4). Switch S1 switches the latches between two sets of port addresses, thus allowing two LED matrix displays to be used together.

used and they are connected to connector CN1 of the Southern Cross. Each board is designed so that the display section may be cut away from the circuit section and connected by flat ribbon cable.

The circuit of the 8x8 LED Matrix display is shown in Fig.3. It is connected to the parallel I/O port of the Southern Cross via connector CN1. Data lines D1-D8 are used to drive two 74HC273 octal D-flipflops, each used as 8-bit latches (IC1, IC2). The eight outputs of the two latches are buffered by the UDN2981A anode driver (IC4) and ULN2803A cathode driver (IC3), respectively. These drive the rows and columns of the 8x8 LED matrix display. Latch IC1 is also connected to the system Reset to ensure that the LEDs are not lit when the circuit is first powered up.

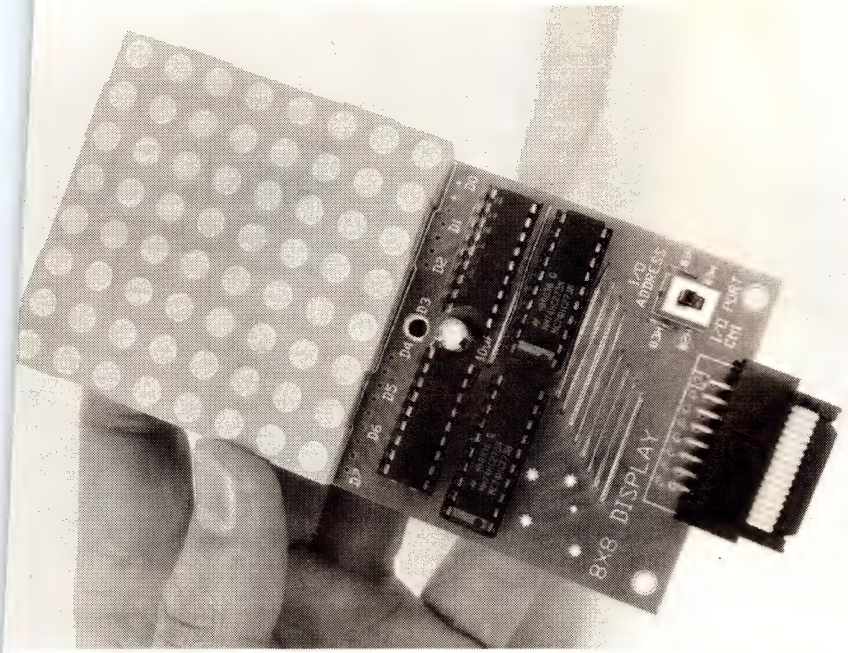
Slide switch S1 switches the latches between two sets of port addresses. In this way, two LED Matrix displays can be used together, one operating from port addresses 80h and 82h and the other operating from port addresses 81h and 83h.

The LED Matrix display is multiplexed and relies on persistence of vision to produce its complex patterns so that moving messages (for example) can be displayed. In the kaleidoscope program, each LED may seem to be on all the time but it is not. Each LED is turned on for only 15 microseconds every half a millisecond. This is a duty cycle of 3%. Peak current through the LEDs is 70mA but the average current is only 2mA.

Constructing the LED display

Assembly of the LED display board does not involve many components and should not take long at all. The component layout diagram is shown in Fig.4. First, fit the 11 wire links to the board. Some of these may be hard to spot. Don't forget the two short links, near the slide switch.

Fit the LED display so that its out-



e 8x8 LED display is, as its name suggests, a matrix of 64 LEDs which are iven in multiplex fashion from the parallel port of the Southern Cross mputer. Note the slide switch to change the address of the display, so that o can be used in conjunction with each other.

ne matches the screen printed outne on top of the board. This is most nportant because if you do it the ther way around the display will be pside down and won't work.

Sockets are supplied for the four Cs and these can be soldered in next. his done, fit the 10µF capacitor, the lide switch and the rightangle flat able connector.

You will have to make up the 16 way cable which uses IDCs (insulaion displacement connectors. These are squeezed together with a vise to apply even pressure to the connector halves.

When you finish each connector, inspect the pins closely to be sure that each pin is connected to the cable strand that it is supposed to go to. It is rather easy when doing hand construction of these cables to find one pin has gone in skewed and is shorting between two adjacent V-pins. Make sure that pin 1 at one end of the cable goes to pin 1 at the other end, and not pin 16.

To check that the board is working the Southern Cross monitor has a kaleidoscope built into it. Put the switch in the up position. This will connect the two latches on the board to ports 80H and 82H. Press Function E. (To remind you – press the Reset key, then the Fn key then the 'E' key.) A pattern of randomly generated symmetric images should appear on the display. This will continue until Reset is pressed.

Programming the 8x8

Multiplexing the 8x8 can be done in several ways. One of them is to use the subroutine already written in the Monitor. In this subroutine, SKATE, one row of 8 LEDs is scanned at a time. The LEDs to be turned on in that row are given by the bit pattern of the 8 positions. A bit pattern of 10000001 (or 81h) will turn on the outer two LEDs. A pattern of 11111111 (FFh) will turn them all on.

To program this, the byte representing the top row is stored in the register pair HL. HL+1 stores the byte for the second row from the top, HL+2 the byte for row 3 etc. We can conveniently use system call 16 to scan the 8x8 display rather than re-invent the wheel and write our own code. An example will show this more clearly.

Using a piece of paper, form the letter A of your choice using the 8x8 matrix. We decided on codes 18, 24, 42, 42, 42, 7E, 7E & 42 as follows:

00011000 = 18h
00100100 = 24h
01000010 = 42h
01000010 = 42h
01000010 = 42h
01111110 = 7Eh
01111110 = 7Eh
01000010 = 42h

Do you see the capital A outlined by the 1's in the code above and how to derive the hex byte representing the 0 & 1 pattern? Hand enter these bytes into locations 2000h to 2007h of the Southern Cross. Next, enter the code shown in Table 1 at 2100h, then do Fn 0. You should have the letter "A" displayed on the LED matrix.

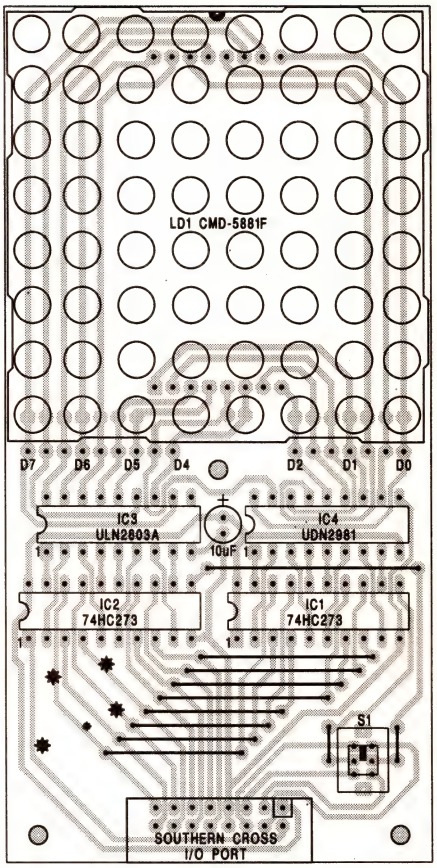
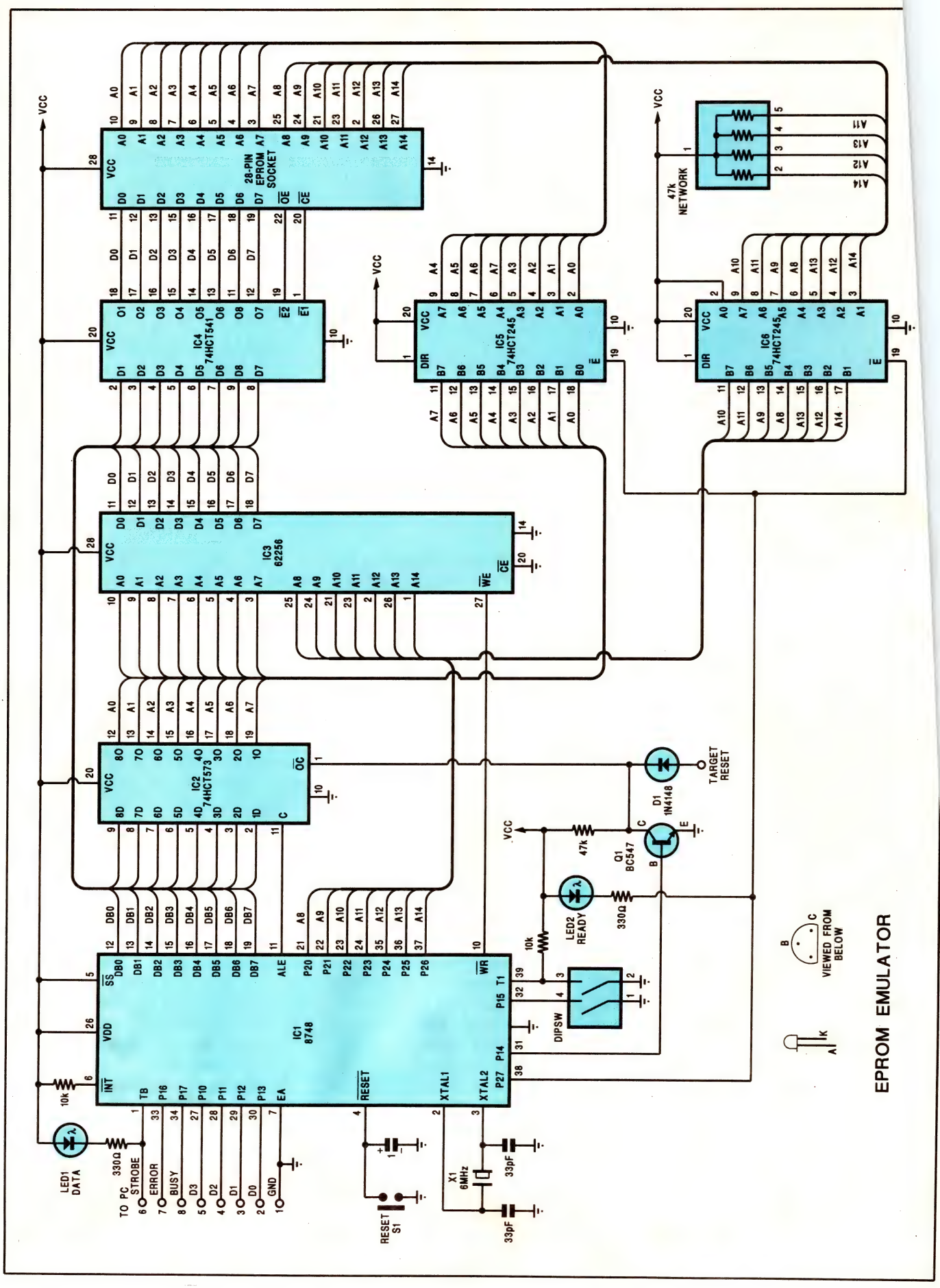
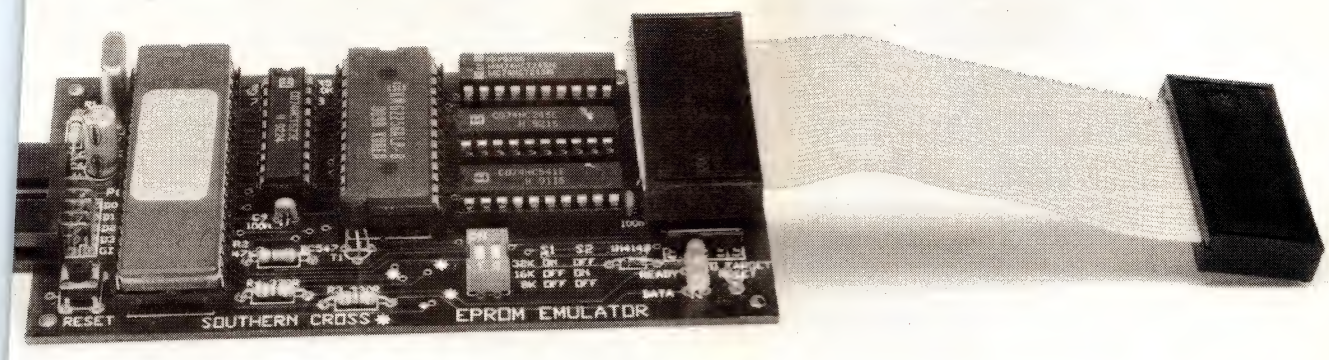


Fig.4: the component layout of the 8x8 LED matrix display. Do not omit the very short links on either side of the slide switch.

Table 1

2100	21 00 20	LD HL,2000H	;point HL to buffer
2103	0E 16	LD C,16H	;system call SKATE
2105	F7	RST 30H	;call it
2106	C3 00 21	JP 2100h	;repeat the loop


EPROM EMULATOR
VCC
IC1 8748
IC2 74HCT573
IC3 62256
IC4 74HCT541
IC5 74HCT245
IC6 74HCT245
28-PIN EPROM SOCKET
47k NETWORK
LED1 DATA
LED2 READY
TO PC
STROBE
ERROR
BUSY
D3
D2
D1
D0
GND
330Ω
10k
47k
DIPSW
RESET S1
X1 6MHz
33pF
Q1 BC547
D1 1N4148
TARGET RESET
VIEWED FROM BELOW



ıe EPROM emulator can be used with the Southern Cross or any other 8-bit computer for that matter. can emulate 8K, 16K or 32K EPROMs.

This example demonstrates how sing the subroutines in the Monitor mplifies code development and re- uces time. Just four lines of code ave put the contents of the 8-word uffer on the display. Add some bit hift instructions, delays and a bigger nessage buffer and you can move a nessage across the screen. Or you can levelop a maze game.

Examples of each of these types of programs, a maze game and a scrolling message program, have been supplied on the floppy disc which accompanies the 8x8 kit.

Now let us look at the last peripheral to be described this month, the EPROM Emulator.

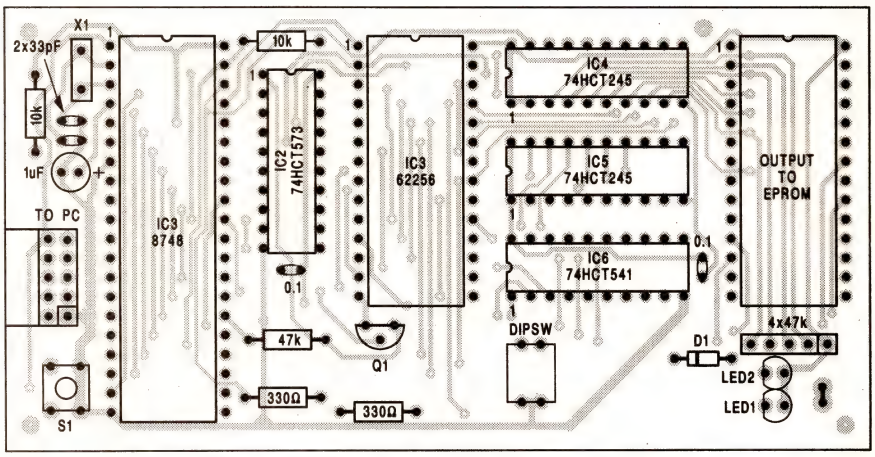


Fig.6: the component layout for the EPROM emulator. Note that all the ICs are mounted in sockets & must be oriented exactly as shown. The device is connected to the Southern Cross computer via a 28-way flat cable fitted with 28-pin DIP headers.

EPROM emulator

This replaces the EPROM in a computer system with RAM. It has a 28-way cable and 28-pin header plug which takes the place of the EPROM in the target computer. In our case, the target computer is the Southern Cross but it could be any computer system which uses an 8K, 16K or 32KEPROM.

The RAM imitates or emulates the EPROM. The target system reads the RAM and thinks it is reading an EPROM. Essentially, it is an independent block ofRAM which can be accessed from two sides: (1) from the target system which can read from it; and (2) from the host PC which can write to it. Hardware and software make sure that simultaneous access from both sides is not possible.

The advantage of this system is that program development time can be a matter of seconds rather than tens of minutes or even hours under the old blow-and-erase cycle. The RAM can be written to by the external computer, so the target system immediately sees a 'new' EPROM. In addition, the emulator gives the capability to download and test other programs in its unused RAM.

The emulator described here is an 'intelligent' design with an 8748 (or 8749) microcontroller and, as already noted, it can emulate 8K, 16K or 32K EPROMs. A floppy disc with a public domain Z80 assembler is provided as well as a Monitor for the Southern Cross and program examples.

The principle of operation is that the program to be tested on the Southern Cross is prepared and assembled in your PC. It is then downloaded to the emulator. While it is being downloaded, the Southern Cross system is held in RESET state. When the transfer is successfully completed, a message appears on the PC screen, the Southern Cross system is released from the RESET state and then it is in control.

The circuit diagram of the emulator is shown in the diagram of Fig.5. Only four of the eight available data lines from the parallel port are used to transfer data from the PC to the emulator. This results in a saving of two ICs and the elimination of a DB25 port connector on the emulator PC board.

The speed cost is about a 10% reduction in data transfer rate compared to that possible if all eight lines were used with DOS commands to do the transfer. This was judged to be an acceptable trade-off in this instance.

◀ Fig.5 (left): the EPROM emulator uses an 8748 microcontroller (IC1). This takes data from the host computer a nibble (four bits) at a time & stores it as 8-bit data in a 62256 static RAM (IC3). The target computer then "sees" the RAM as a normal EPROM.

Table 2			
IDC Pin	Name	Male Sub-D Pin #	Cable Strand #
1	Ground	18-25	1
2	Data line 0	2	3
3	Data line 1	3	5
4	Data line 2	4	7
5	Data line 3	5	9
6	Strobe	1	10
7	Error	15	8
8	Busy	11	6
9 &10	Not Connected		4 & 2 resp.

Prices & availability

Since the first article on the Southern Cross in August 1993, the prices for the kits have needed to be adjusted to compensate for currency movements. The prices are as follows:

Southern Cross Computer $194
Dallas 1213B SmartSocket $63
Dallas 1216B SmartSocket $84
8x8 LED Display $73
EPROM Emulator $129
Technical manual of IC data sheets $12

The kits containing all the components may be ordered in Australia from Alpine Technology, PO Box 934, Mt Waverley, Vic 3148. Phone or fax (03) 751 1989. You may pay by Bankcard, Mastercard, cheque or money order. Buyers outside Australia should contact DIY Electronics in Hong Kong. Phone/fax (852) 725 0610.

Parts List for the EPROM Emulator

1 PC board, 114 x 58mm
1 6MHz crystal
1 2-way DIP switch
1 miniature momentary contact switch (S1)
1 200mm-long 28-strand ribbon cable
1 150mm-long 10-strand ribbon cable
2 28-pin DIP headers
1 10-pin IDC connector
1 10-pin box header connector
1 25-pin male sub-D connector
1 25-pin sub-D case
1 40-pin IC socket
1 28-pin IC socket
4 20-pin IC sockets

Semiconductors

1 8748 microcontroller (IC1)
1 74HCT573 octal Tri-state D flipflop (IC2)
2 74HCT245 octal Tri-state transceivers (IC5, IC6)
1 74HCT541 octal Tri-state buffer (IC4)
1 62256 static RAM (IC3)
1 BC547 NPN transistor (Q1)
1 1N4148 signal diode (D1)
1 3mm yellow LED (LED 1)
1 3mm green LED (LED2)

Capacitors

1 1µF electrolytic
1 0.1µF monolithic
2 33pF ceramic

Resistors

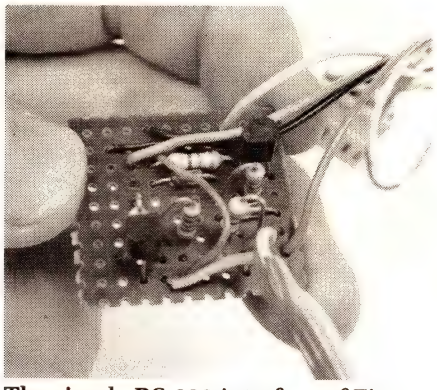
1 47kΩ SIL resistor network
1 47kΩ ¼W
1 10kΩ ¼W
1 330Ω ¼W

The emulator board, emulator software and the software which you are already using in your PC must combine together to operate the EPROM emulator.

Power for the emulator comes from the Southern Cross via the 28-pin socket. The 2-way DIP switch selects the size of EPROM to be emulated. To emulate the Southern Cross (8K EPROM), both DIP switches will be in the OFF position.

The 8748 microcontroller receives the program from the PC a nibble (4 data bits) at a time. It assembles them into bytes (8 data bits) and generates the address and all the timing signals to write the byte into the 62256 static RAM. It also controls the target (ie, the Southern Cross) system via the RESET line, reads the DIP switches, and communicates back to the PC.

IC2 is a 74HCT573 Tri-state octal D-type latch which is controlled by the 8748 to switch data from the four input data lines into the addresses of the static RAM (IC3). IC4, IC5 and IC6 are also Tri-state chips which are controlled by the target computer (via the 8748) in accessing data stored in the RAM when the circuit is emulating EPROM.



The simple RS-232 interface of Fig.2 can be built up on a small piece of Veroboard as shown here.

Construction

All the components are mounted on a double-sided PC board which is screen printed on top to show the layout – see Fig.6. Sockets are used for all the ICs and these can be placed and soldered after all the small components are inserted. Make sure that the transistor, the two LEDs, the diode and the electrolytic capacitor are inserted with correct polarity.

A single wire connects the "TO TARGET RESET" pads of the emulator to RESET on the target system.

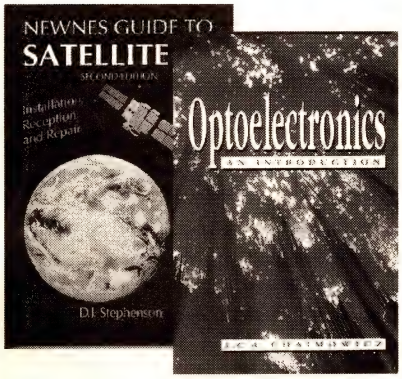
Two cables with IDC connectors need to be made up. One cable con-

Continued on page 88

Silicon Chip Book Shop

Dedicated To Bringing You Books On State Of The Art Technology

These books are written by acknowledged specialists in their fields and will fill a longfelt requirement for reference texts. Each book is up to date, well written and most importantly, available now.



Satellite TV

Newnes Guide to Satellite TV; Installation, Reception & Repair. By Derek J. Stephenson. 2nd edition, published 1991, reprinted 1992.

This is a practical guide on the installation and servicing of satellite television equipment. The coverage of the subject is extensive, without excessive theory or mathematics. 284 pages, in hard cover at $45.95.

Optoelectronics

Optoelectronics: An Introduction, by J. C. A. Chaimowicz. First published 1989, reprinted 1992.

This field is about to explode and it is most important for engineers and technicians to bring themselves up to date. The subject is comprehensively covered, starting with optics and then moving into all aspects of fibre optic communications. 361 pages, in paperback at $55.95.

Linear Electronic Design

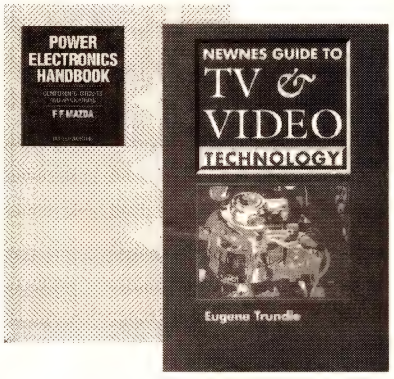
The Art of Linear Electronics, by John Linsley Hood. Published 1993.

This is a practical handbook from one of the world's most prolific audio designers, with many of his designs having been published in English technical magazines over the years. A great many practical circuits are featured - a must for anyone interested in audio design. 336 pages, in paperback at $49.95.

Digital Audio

Digital Audio and Compact Disc Technology. Produced by the Sony Service Centre (Europe). 2nd edition, published 1992.

Prepared by Sony's technical staff, this is the best book on compact disc technology that we have ever come across. It covers digital audio in depth, including PCM adapters, the Video8 PCM format and R-DAT. If you want to understand digital audio, you need this reference book. 247 pages, in paperback at $59.95.



Power Electronics

Power Electronics Handbook, Components, Circuits & Applications, by F. F. Mazda. Published 1990.

Previously a neglected field, power electronics has come into its own, particularly in the areas of traction and electric vehicles. F. F. Mazda is an acknowledged authority on the subject and he writes mainly on the many uses of thyristors and Triacs in single and three phase circuits. 417 pages, in soft cover at $59.95.

TV & Video

Newnes Guide to TV & Video Technology, by Eugene Trundle. First published 1988, reprinted 1990, 1992.

Eugene Trundle has written for many years in *Television* magazine and his latest book is right up date on TV and video technology. 432 pages, in paperback, at $39.95.

To order any of these books, fill out the coupon below & send it with your remittance to SILICON CHIP

Your Name_____
PLEASE PRINT

Address_____

_____ Postcode_____

Daytime Phone No._____ **Total Price $A** _____

❑ Cheque/Money Order ❑ Bankcard ❑ Visa Card ❑ Master Card

Card No. | | | | | | | | | | | | | | | |

Signature_____ Card expiry date____/____

Books Required (please tick)

- ❑ Newnes Guide to Satellite TV ($45.95)
- ❑ Optoelectronics: An Introduction ($55.95)
- ❑ The Art Of Linear Electronics ($49.95)
- ❑ Digital Audio & Compact Disc Technology ($59.95)
- ❑ Power Electronics Handbook ($59.95)
- ❑ Newnes Guide to TV & Video Technology ($39.95)

Mail coupon to: Silicon Chip Publications, PO Box 139, Collaroy NSW, Australia 2097.

Or call (02) 979 5644 & quote your credit card details; or fax the details to (02) 979 6503.

VINTAGE RADIO

By JOHN HILL

My no-hassles radio museum

Most of my collection now sits on show in a new museum in Maryborough. It didn't cost me a cent & I only have to spend as much time there as I choose. Here's how it all came about.

Way back in the October 1991 issue of SILICON CHIP, I did a story on two Victorian radio museums – the "Catswisker" museum in Chiltern and the "Orpheus" museum in Ballarat. In that particular article, I expressed the desire to have my own radio museum but dismissed the idea at the time due to the many problems associated with such a project.

Some of these problems are: finding a suitable building in an appropriate place, the overall expense of such a venture and the time spent in managing the museum itself. It doesn't take long to realise that a private museum could be a bad financial proposition. In many instances, the expense of setting up may never be recouped because of poor returns and ongoing costs. Not all museums are successful ventures!

It is interesting to note that, at the time of writing, the "Catswisker" collection has been for sale for quite some time and the "Orpheus" collection has been relocated to one of Ballarat's other tourist attractions.

The small number of people visiting the original Orpheus museum did not justify the amount of space it occupied. Richard Wilson's growing electronics business needed room to expand and the museum space had to be utilised.

Personally, that was a bit of a blow because it meant the end of my Sunday job. Well, we are in tough times, so I guess that part time museum c rators are expendable.

Bob Adkins of the Catswisker four the museum a tie and it prevente him from doing all the things retire people like to do. Because of his m seum commitments, he was unable t go away for a month or so and enjoy holiday. Someone had to be there i case tourists wanted to see the mu seum. Richard Wilson was in a simi lar situation and he employed me o Sundays because it was the only wa he could have a day off.

My museum

All of the forgoing put me in a good position to realise that having your own radio museum is not all fun and admission dollars. I was indeed fortunate to have this first-hand information as it prevented me from putting myself in a similar situation.

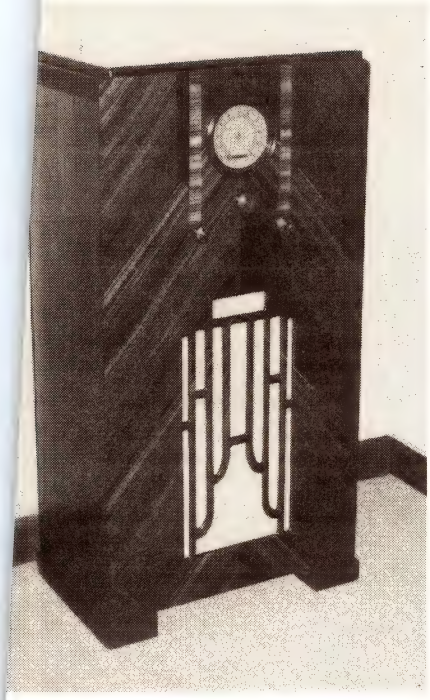
However, things happen in mysterious ways and it seems as though I was destined to have a radio museum. What's more, it is now a reality.

The good part about "my" museum is that it hasn't cost me a cent and it will require no more of my time than I care to put into it. Yes, I know that it all sounds too good to be true, so allow me to explain some of the details.

In the small rural city in which I live (Maryborough, Victoria), there is a group of people who call themselves "Golden Era Steam and Rail, Maryborough". Basically, they are interested in steam power and railways but they also have some affiliation with the local "Creative Arts" group. In fact, many members belong to both groups.

Together, they decided that Maryborough needed an additional tourist attraction and reckoned that a top class museum would be a great asset for the

The radio museum has been tastefully arranged, with the exhibits being well-spaced & uncluttered. Most of the receivers are in working order.



The radio museum has five console style receivers on display, all of which are in working order. This one is a mid-1930s model Commodore, a 5-valve autodyne superhet.

This corner of the museum houses a collection of test instruments. Shown are valve testers signal generators, oscilloscopes & other items of test equipment from the past.

The radio receivers are displayed on shelves or pedestals of various heights. At this stage, there is plenty of room to accommodate additional exhibits.

city. Accordingly they sent letters to several local collectors (myself included), inviting them to attend a meeting to discuss plans for a museum and to have "meaningful talks".

Those invited to that first meeting were Bill Harper, Bill Holland, Warren Tattersall and myself, plus delegates from the Maryborough City Council and a few other interested people.

Bill Harper is a retired radio technician who spent about 40 years with radio station 3CV Central Victoria, which transmits from Maryborough. He has worked in many different aspects of radio, including being an announcer. In early broadcasting, people had to be versatile.

Bill Holland is in his 70s and is a radio/TV repairman from way back. He is also a collector of old radios and associated equipment which he has acquired during his lifetime. Warren Tattersall runs a camera shop in town and is a keen collector of cameras and photographic equipment.

What the Golden Era Steam and Rail people had in mind was to utilise the three collections as the basis for a museum display, adding to it as time progressed.

Bill Harper's task was an advisory one. It was hoped to build a replica of 3CV's original broadcasting studio and as Bill is one of the few people still around who remembers what it looked like, his input was invaluable.

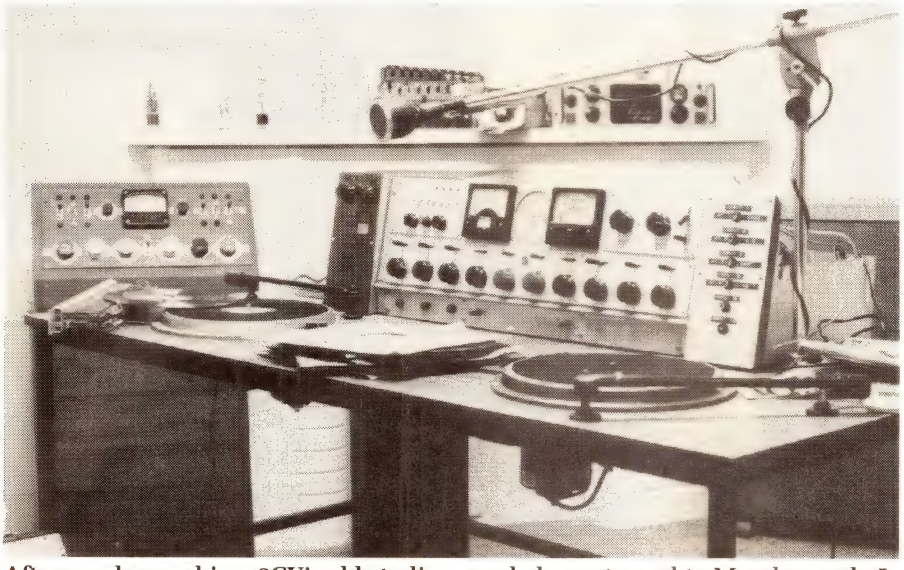
It was also planned that the studio would be connected to a street loudspeaker system, enabling music and announcements to be "broadcast" to shoppers and city visitors in High Street, the main shopping area. The studio was to use the call sign 3HHH, the "triple H" standing for Harper, Hill and Holland.

It was a bold plan and its main instigator was Jim Tanner. Jim had a vision in his mind's eye about every detail of the museum and without his efforts the museum complex may never have been completed – or even started for that matter!

A building was available in High Street, its position being a great advantage because of its central location. This building has since been extensively altered to accommodate an arts and crafts shop at the front, the museum complex in the middle and an art studio at the rear. The building is quite large and it runs from the main street through to the street behind where there is ample room for parking (including tour buses).

The City Council provided a loan to help get things started. Such an enterprise cannot succeed without a sizable injection of funds. As the Creative Arts group comes under council

Bill Holland's 1920s corner – a display of early loudspeakers & regenerative receivers. Bill also has a glass cabinet full of early radio equipment & other interesting items.



After much searching, 3CV's old studio console has returned to Maryborough. It was retrieved from a collector in Deniliquin.

control, that makes the museum, in effect, affiliated with the council which is a definite advantage for an undertaking of this magnitude.

Another good aspect of the museum project is the fact that a large proportion of the work was done by volunteers and approximately 30 people toiled relentlessly in order to outfit the museum and renovate the building. These people have helped considerably in containing costs to a reasonable level.

Naturally, there had to be proper steps taken to protect and insure the exhibits, because the collections involved are worth many thousands of dollars. Establishing a museum costs money – big money – and I was glad that my personal finances were not involved.

An agreement has been signed by all parties concerned to the effect that the collections are on loan for a minimum 5-year period, after which a new agreement will be negotiated. Part of the agreement also states that if the items on loan are subjected to unreasonable damage due to poor supervision or careless handling, the collections can be withdrawn by their owners.

Dust problems

I noticed during my time at the Orpheus museum that dust can be a problem as far as valuable old rad are concerned. Admittedly, I'm a natic when it comes to dust bu dusty display area will eventually duce a well-restored radio to son thing of lesser value. Over a period time, dust and its constant remov can do considerable damage to p ished surfaces such as those on ti ber and bakelite radio cabinets.

My collection of radios has alwa been kept under wraps and in a dar ened room. The reason for the dar ened room is that continual exposu to sunlight will fade timbers an speaker cloths and eventually destro the delicate paintwork on dial glasse Some plastics also react unfavourabl to regular daily doses of sunshine.

If the Golden Era Steam and Rai people wanted to display my radi collection they would have to look after it in a similar manner. And so a dust-free environment was another aspect of the agreement.

Dust control has been achieved by relatively simple means. The display area for the radios is basically a very large carpeted room with three archways for entrances. Filtered air is pumped into this room to create a slight pressure build-up. The air thus continually flows out of the room and this prevents dust from coming in.

The dust-free room may not be 100% dust proof but it is very close to it. As entry to the museum is through the arts and crafts shop, that area acts as a buffer zone for the museum. The filtered air method of dust control is a far better arrangement than doing nothing at all about it.

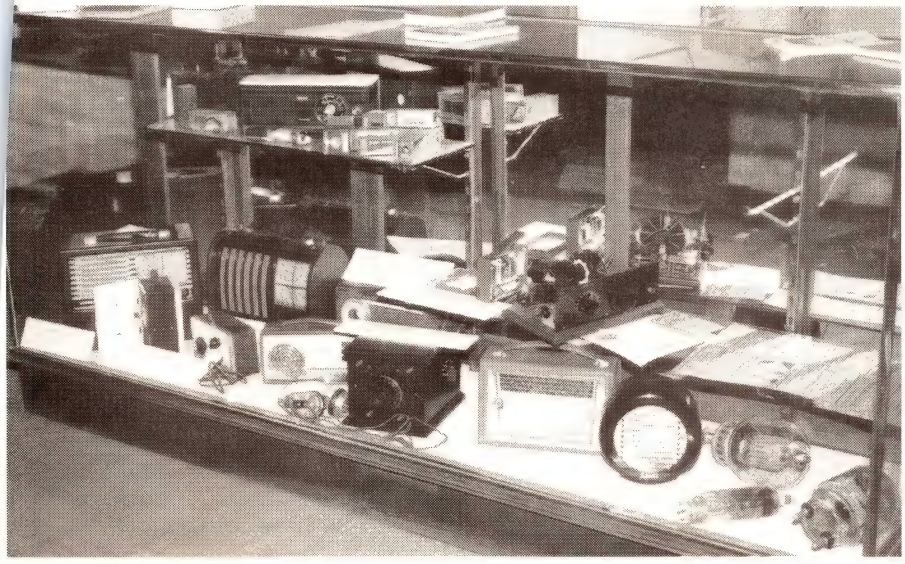
Running the museum on a daily basis is made possible by a team of helpers who give what time they can. Once again, costs are kept to a minimum because of volunteers.

The next stage

The completion of the radio museum sees the end of stage one of the proposed development. The camera display is next on the list and will be followed by another area which will include antiques, collectables and memorabillia. These items will be supplied by interested local supporters.

Already in place is a huge twin-cylinder, double-acting steam engine and alternator. The old steam engine originally powered the Maryborough Knitting Mill and lit up the streets of the city back in the days before

These three Stromberg-Carlson receivers are all on display at the Museum of Creative Arts & Sciences. They are all post-war models.



Many smaller items, including some early transistor radios, are on show in this glass cabinet. Perhaps the most interesting exhibit here is the well constructed home-made crystal set (centre front).

Maryborough was connected to the SEC power grid. A display of early lighting is planned to complement this part of the museum.

The Central Victorian Car Club has also offered to display the odd vintage car for short periods from time to time if space permits. It appears as though the Museum of Creative Arts and Sciences will be well supported by various groups and individuals.

Now some readers may be surprised to read that I have let my collection of old radios go out of my control, so to speak, for a period of five years or more, as the case may be. Well, to be perfectly honest, I was glad to see them go because they had taken up so much space at home and storage was becoming a real hassle. Marital problems were imminent if something wasn't done!

For the first time in many years I now have room to move and work in my den and it's great feeling! If you are in a similar situation with more radios than you have storage space for, then just give them away for five years – it solves the problem instantly!

A few toys

Of course I wasn't generous enough to give everything away and I've kept some of my real treasures. A bloke my age needs a few toys to play with when the mood demands it.

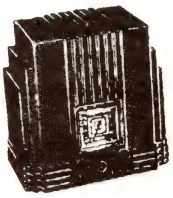
So there it is! "My" museum is a reality, it cost me nothing to set up, I don't have to look after it and I have access to it at any time. What's more, the radios are well insured and I can take them back if they are not looked after. That's a very good arrangement as far as I'm concerned!

Really, it's great to have my collection on permanent display. It should be available for people to see instead of being locked up in a dark room where no one can appreciate those fine old receivers from yesteryear.

I might add that those fine old receivers have taken me nearly 10 years to find and restore, so the radio museum display represents most of my spare time for the past decade. If you're ever driving through Maryborough, be sure to call in and take a look. The museum hours are 10am-4pm Monday to Saturday and 1pm-4pm on Sundays.

Footnote: since writing the above, John Hill advises that the replica 3CV studio may soon become a genuine radio studio. The museum committee has applied for a broadcast licence and hopes to start a community radio station, using a 10W transmitter on the AM band. **SC**

RESURRECTION RADIO



Vintage Wireless Specialists

Repairs – Restoration – Sales

Our skilled technicians offer QUALITY repairs and restoration.

We also have a large stock of bakelite and timber radios fully restored and for SALE.

Parts are available for the enthusiast, including over 900 valve types, high voltage capacitors, transformers, dial glasses, knobs, grille cloth etc.

Circuit diagrams for most Australian makes and models.

Send SAE for our catalog.

WANTED: Valves, Radios, etc. Purchased for CASH

Call in to our showroom at:

51 Chapel Street (PO Box 1116), Windsor, Vic 3181.

Phone: (03) 529 5639; Fax (03) 510 4486

ELECTRONICS ROD IRVING ELECTRONICS ROD IRVING ELECTRONICS ROD IRVING ELECTRONICS ROD IRVING ELECTRONICS ROD IRVING ELECTRONICS ROD IRVING ELECTRONICS ROD IRVING ELECTRONICS

RITRON COMPUTERS SYSTEMS

OPTIONAL EXTRA'S
ON TOP OF THE BASE SYSTEMS PRICE

MS DOS 6.0 & WINDOWS 3.1.....$169.00
1M VGA CARD VESA VGA CARD.....$99.00
VESA LOCAL BUS I / O $99.00
386DX-40 UPGRADABLE M.board.....$100.00
LOCAL BUS VESA GRAPHIC CARD
TO SUIT ABOVE MOTHERBOARD.....$199.00

TO CHANGE A 131M HARD DRIVE TO A ,
212 MEG HARD DRIVE add.....$60
260 MEG HARD DRIVE add $140
345 MEG HARD DRIVE add $250
425 MEG HARD DRIVE add $470
525 MEG HARD DRIVE add $870
15" Monitor XGA Digital.....$340

EXTRA RAM
1M add..$99 2M add..$198 4M add..$398

SOUND CARDS
SOUND BLASTER DELUXE 2
(With Speakers).....$119
SOUND BLASTER PRO DELUXE.....$229
FLOPTICAL DRIVE add.....$649
21M / BYTE DISC TO SUIT.....$49
PARADISE TURBUO ACCELERATOR....$185
VESA PARADISE ACCELERATOR.....$350
CIRRUS WINDOWS ACCELERATOR.....$199

CASES
MINI TOWER....$25 FULL TOWER.....$175

RITRON EXECUTIVE
386SX-47

80386SX-40 CPU
2 MEG RAM EXP TO 8 MEG
47Mhz LANDMARK SPEED TEST
1.2M JAP F.D.D. 512K VGA CARD
131M HARD DISK DRIVE
101 EXTENDED "CLICK" KEYBOARD
MINI CASE & POWER SUPPLY
SUPA VGA COLOUR MONITOR
1024 X 768 Res 0.28" D.P
SERIAL, PARALLEL & GAMES PORT
4 YEARS PARTS & LABOUR
WARRANTY IBM* COMPATIBLE
18 M OF SHAREWARE: INC. LATEST VGA GAMES SPREADSHEET, WORDPROCESSOR & DATABASE SOFTWARE INCLUDED
*SHAREWARE SOFTWARE

8 ISA SLOTS

NOW WITH 2 MEG OF RAM!

ASSEMBLED & TESTED IN AUSTRALIA

$1,359 Tax Inc
$1125 Tax ex

RITRON EXECUTIVE
386DX-65

UPGRADABLE 2 SLOT VESA MOTHERBOARD

80386DX-40 CPU
128K CACHE ON BOARD MEMORY
4 MEG RAM EXP TO 16 MEG
65Mhz LANDMARK SPEED TEST
1.2M JAPANESE F.D.D.
131M HARD DISK DRIVE
101 EXTENDED "CLICK" KEYBOAI
MINI CASE & 200W POWER SUPPLY
SUPA VGA COLOUR MONITOR
1024 X 768 Res 0.28" D.P
1 MEG VGA CARD
4 YEARS PARTS & LABOUR
WARRANTY IBM* COMPATIBLE
SPREADSHEET,WORDPROCESSOR & DATABASE
SOFTWARE INCLUDED
*SHAREWARE SOFTWARE
ASSEMBLED & TESTED IN AUSTRALIA.

5 ISA SLOTS
2 VESA SLOTS

NOW WITH 4 MEG OF RAM!

WITH 212M DRIVE

$1,795 Tax Inc
$1490 Tax ex

$1,855 Tax Inc
$1540 Tax ex

RITRON EXECUTIVE
486DX-157

80486DX-33 CPU
256K CACHE ON BOARD MEMORY
4 MEG RAM EXP TO 32 MEG
157Mhz LANDMARK SPEED TEST
1.2M JAPANESE F.D.D.
131M HARD DISK DRIVE
101 EXTENDED "CLICK" KEYBOARD
MINI CASE & 200W POWER SUPPLY
SERIAL,PARALLEL,GAMES PORTS
1MEG VGA CARD, SUPA VGA COLOUR MONITOR
(1024 X 768 Res) 0.28" D.P
4 YEARS PARTS & LABOUR
WARRANTY IBM* COMPATIBLE
SPREADSHEET,WORDPROCESSOR & DATABASE SOFTWARE INCLUDED
*SHAREWARE SOFTWARE

3 SLOT LOCAL BUS MOTHERBOARD

NOW WITH 4 MEG OF RAM!

$2,095 Tax Inc
$1,735 Tax ex

WITH 212M DRIVE
$2,155 Tax Inc
$1,780 Tax ex

RITRON EXECUTIVE
486-157 VESA

80486DX-33 CPU
256K CACHE 4 MEG OF RAM
157Mhz LANDMARK SPEED TEST
1.2M JAPANESE F.D.D.
212M HARD DISK DRIVE
101 EXTENDED "CLICK" KEYBOARD
MINI CASE & 200W POWER SUPPLY
VESA SUPER I/O CARD
SERIAL, PARALLEL, GAMES PORT
VESA 1MEG VGA CARD, SUPA VGA COLOUR MONITOR
(1024 X 768 Res) 0.28" D.P
4 YEARS PARTS & LABOUR
WARRANTY IBM* COMPATIBLE
SPREADSHEET,WORDPROCESSOR & DATABASE SOFTWARE INCLUDED
*SHAREWARE SOFTWARE
ASSEMBLED & TESTED IN AUSTRALIA

NOW WITH 3 SLOT LOCAL BUS MB

NOW WITH 4 MEG OF RAM!

WITH 424M DRIVE

$2,435 Tax Inc
$1,999 Tax ex

$2,845 Tax Inc
$2,355 Tax ex

RITRON EXECUTIVE
486DX-157 VESA TOWER

80486DX-33 CPU
256K CACHE 4MEG OF RAM
157Mhz LANDMARK SPEED TEST
1.44M JAPANESE F.D.D.
212M HARD DISK DRIVE
5ms T.T ACCESS
101 EXTENDED "CLICK" KEYBOARD
SERIAL, PARALLEL, GAMES PORT
1 MEG VESA VGA CARD
SUPER VESA I / O CARD
TOWER CASE & 200W POWER SUPPLY
15" NON-INTERLACED COLOUR MONITOR 1024 X 768 Res 0.28" D.P
4 YEARS PARTS & LABOUR
WARRANTY IBM* COMPATIBLE
SPREADSHEET,WORDPROCESSOR & DATABASE SOFTWARE

IDEAL FOR DESKTOP PUBLISHING

NOW WITH 4 MEG OF RAM!

ASSEMBLED & TESTED IN AUSTRALIA

$3,100 Tax Inc.
$2,560 Tax ex.

RITRON EXECUTIVE
486DX-225+

80486DX2-50 CPU
256K CACHE 4 MEG OF RAM
225+ MHz LANDMARK SPEED TEST
1.44M JAPANESE F.D.D.
1.2 JAPANESE F.D.D.
212M HARD DISK DRIVE 5ms T.T ACCESS
SUPER I / O LOCAL BUS
101 EXTENDED "CLICK"KEYBOARD
SERIAL, PARALLEL, GAMES PORT
VESA 1 MEG VGA CARD
MINI TOWER CASE & 200W POWER SUPPLY
NON-INTERLACED COLOUR MONITOR 1024 X 768 Res 0.28" D.P
4 YEARS PARTS & LABOUR
WARRANTY IBM* COMPATIBLE
SPREADSHEET,WORDPROCESSOR & DATABASE SOFTWARE

NON-INTERLACED MONITOR

7 ISA SLOTS OF WHICH 3 ARE ALSO LOCAL BUS COMPATIBLE

212M HARD DRIVE

4 MEG OF RAM!

ADD $200 FOR DX2-66

ASSEMBLED & TESTED IN AUSTRALIA.

$2,795 Tax Inc.
$2,295 Tax ex.

RITRON EXECUTIVE
DX2 - 66

80486DX2-66 CPU
256K CACHE 4MEG OF RAM
167Mhz LANDMARK SPEED TEST
1.44M JAPANESE F.D.D.
1.2M JAPANESE F.D.D.
212M HARD DISK DRIVE 5ms T.T ACCESS
SUPER VESA I / O CARD
101 EXTENDED "CLICK"KEYBOARD
SERIAL, PARALLEL, GAMES PORT
VESA 1 MEG VGA CARD
TOWER CASE & 200W POWER SUPPLY
NON-INTERLACED COLOUR MONITOR 1024 X 768 Res 0.28" D.P
4 YEARS PARTS & LABOUR
WARRANTY IBM* COMPATIBLE
SPREADSHEET,WORDPROCESSOR & DATABASE SOFTWARE
ASSEMBLED & TESTED IN AUSTRALIA.

NON-INTERLACED MONITOR

7 ISA SLOTS OF WHICH 3 ARE ALSO LOCAL BUS COMPATIBLE

212M HARD DRIVE & TOWER

4 MEG OF RAM!

$2,995 Tax Inc.
$2,460 Tax ex.

RITRON EXECUTIVE
20" CAD/GRAPHIC WORKSTATION
486DX-250+

486DX-50 UPGRADEABLE MOTHERBOARD WITH LOCAL BUS *MINI TOWER CASE WITH 200W POWER SUPPLY *8 MEG FAST PAGE MODE 60ns RAM VESA HIGH SPEED GRAPHICS CARD (LOCAL BUS) *CD ROM *425M HARD DRIVE 5ms ACCESS *TWO SERIAL PORTS & ONE PARALLEL PORT *3½ FLOPTICAL DISK DRIVE *DIAMOND STEALTH CARD *1.2 M'BYTES FLOPPY DISK DRIVE *TAPE BACK-UP *101 HEAVY DUTY ERGONOMIC KEYBOARD *WINDOWS 3.1 & DOS 6.00 INSTALLED *20" SUPA VGA MULTISYNC MONITOR *MICROSOFT COMPATIBLE MOUSE *FOUR YEARS ONSITE LABOUR (WITHIN 50Km OF OUR NUNAWADING (MELB) SERVICE CENTRE & MANUFACTURERS PARTS WARRANTY *FREE ONSITE DELIVERY *ON-LINE 9-5 TELEPHONE HELP LINE. SPECIALLY SELECTED COMPONENTS FOR MAXIMUM SPEED

20" SUPA VGA COLOUR MULTISYNC MONITOR

$7,995 Tax Inc.
$6,995 Tax ex.

ERRORS AND OMISSIONS EXCEPTED. MOTHERBOARD SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE.
PRICES SUBJECT TO CHANGE WITHOUT NOTICE DUE TO CURRENCY FLUCTUATIONS AND COMPONENT PRICE CHANGES. SILICON CHIP DECEMBER 1993

ELECTRONICS ROD IRVING ELECTRONICS ROD IRVING ELECTRONICS ROD IRVING ELECTRONICS ROD IRVING ELECTRONICS ROD IRVING ELECTRONICS ROD IRVING ELECTRONICS ROD IRVING ELECTRONICS

ROD IRVING ELECTRONICS

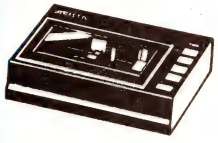
END OF YEAR AUDIO CLEARANCE SALE

KEY LOCKDOWN ANTENNA

Four Sections
- 860mm long extended
- 1.2metre lead with plug

A12073 Was $10.95

Sale Price.. $6.95

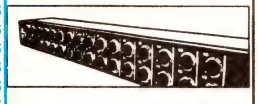


VHS VIDEO TAPE REWINDER AND CLEANER

A VHS tape rewinder that wont break tapes. Fitted with photo sensors that automatically stops the tape as soon as the leader tape is detected in the fast forward and rewind modes. This prevents the tape from being pulled out of the hub. A small built in vacuum cleaner automatically dehumidifies the tape as well as expelling any magnetic particles dislodged during VCR playing. Functions include easy loading with hydraulically operated tape holder, push button tape counter and auto power off at the end of rewinding/fast forward. It comes complete in an attractive, freestanding, heat resisting black cabinet.

A11460 Was $122.95

Sale Price $79.95



16 CHANNEL PATCHBOX

Ideal for studios, bands, and audio workshops. Two banks, each with 16 pairs of sockets designed to accept effect pedals, musical instruments amplifiers, mixers equalizers etc.

A14460 Was 179.95

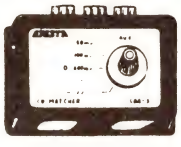
Sale Price $129.95

MICROPHONE CABLE & LEAD TESTER

Designed to test balanced and unbalanced cables with three pin XLR connectors as well as leads with 6.5mm phone or RCA plugs. Ideal for checking patch leads and long cable runs before they are installed and before they can damage equipment. Operates with a single 9 volt internally mounted battery and utilizes easy to read LED's for quick readings whist out on the job.

A10532 Was $49.95

Sale Price $34.95

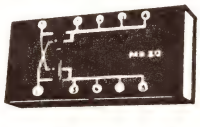


ADJUSTABLE CD/ AUX TWO WAY INPUT SWITCH

Many amplifiers do not have an input for CD players. This unit allows you to run both a CD player and another component through a single auxiliary / line input on your amplifier.
- Variable input attenuator matches the CD signal to the amp.
- Easy selection of CD or Auxiliary witha rotary switch

A11510.. Was $40.95

Sale Price $29.95



MIDI EXPANDER

This MIDI (Musical Instrument Digital Interface) expander is a parallel box desinged espesially for Digital interfacing of most keyboards, sequencers and musical instruments with 5 pin DIN MIDI socket outputs. Switching allows one keyboard / sequencer to control up to eitgh keyboards or two keyboards / sequencer to control up to four keyboards each.

A12014 Was $110.95

Sale Price.$87.95

VIDEO LEADS SPECIALS

The following range of Scart leads are ideal for VCR to TV interlinking. They all see high quality shielding cable on all pins needed fro recording and playback of mono and stereo video / audio signals

SCART PLUG TO SCART PLUG
- **1.5 Metres**

P32303 Was $30.05

Sale Price..$21.95

SCART PLUG TO SCART PLUG
- **3 Metres**

P32304 Was $35.95

Sale Price...$26.95

SCART PLUG TO SCART PLUG
- **ROUND CABLE**
- **1.5 Metres**

P32305 Was $33.95

Sale Price...$24.95

SCART PLUG TO SCART PLUG
- **ROUND CABLE**
- **3 Metres**

P32307 Was $44.95

Sale Price...$34.95

The above lead has all 21 pins connected through and is designed for pure RGB signals as used with computer monitors & terminals.

SCART TO SCART PLUG FLAT CABLE
- **1.5 Metres**

P32301 Was $39.95

Sale Price..$29.95

SCART TO 6 PIN DIN
- **SWITCHABLE**
- **1.5 Metres**

P32302 Was $9.95

Sale Price $6.95

SCART TO 5 PIN PLUG & 2 x BNC PLUGS
- **1.5 Metres**

P32306 Was $31.95

Sale Price $21.95

SCART TO 4 x RCA PLUGS & 2 BNC PLUGS
- **1.5 Metres**

P32308 Was $30.95

Sale Price $21.95

SCART PLUG TO 6 x RCA PLUGS
- **1.5 Metre**

P32310 Was $29.95

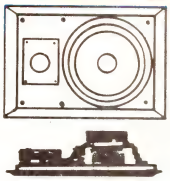
Sale Price $19.95

LENS CLEANING KIT

Lens cleaning and maintainance kit designed for use with video cameras, binoculars etc.
Contains:
- Plastic dust blower with brush
- Bottle of cleaning fluid
- Lint free optical cloth
- Cotton swabs 5 piece
- Lens tissues-50 pieces

A10013 Was $9.95

Sale Price $5.95



5.25" TWO WAY FLUSH WALL MOUNT SYSTEM

A modern 2 way speaker system not only designed to accurately reproduce digital & other Hi Fi recordings, but will stylishly blend into your wall decor. It is a compact, weather and moisture resistant wall speaker system with a 5.25" polypropolene woofer and 1" mylar tweeter with high pass filter capacitor to protect the tweeter from damaging low frequencies .

C10708..Was $199.00 pr

Sale Price $149.00 pr

6.5 " TWO WAY FLUSH WALL MOUNT SYSTEM

A modern 2 way speaker system that easily blends into your existing wall decor. They are weather and moist resistant and come with a specially designed 6" polypropolene woofer with a linear long through throw foam edge surround and high temperature 1" soft dome tweeter. Unique to this particular wall speaker baffle system is its ability to automatically detect when the system is being overdriven. If this situation arises, electrical current is restricted between the amplifier, crossover and tweeter preventing damage. The polyswitch circuit that controls this function will automatically re-engage once the volume is turned down to acceptable level.

C10710 Was $279.95

Sale Price $199.00 pr

STOCKS ARE VERY LIMITED. PLEASE PHONE OUR MAIL ORDER DEPARTMENT OR YOUR NEAREST STORE FOR AVAILABILITY.

ROD IRVING ELECTRONICS

ROD IRVING ELECTRONICS

PRICES SLASHED AGAIN ON ALL PRINTERS
15% OFF ALL KITS THIS WEEK

OUR NEW 148 PAGE CATALOGUE IS OUT NOW.

PICK UP YOUR FREE COPY AT ANY ONE OF OUR STORES

COMPUTER SYSTEMS

486 SYSTEMS HAVE 3 SLOT LOCAL BUS

386DX-40
$1295
INCLUDING TAX $1579

486DX-33
$1790
INCLUDING TAX $2165

486DX-50
$2120
INCLUDING TAX $2565

All Systems include 4 Meg RAM, 212 Mb H.D. • 1 F.D.D (3.5 or 5.25") • 2 SPG ports, 101 Keyboard, • Supa VGA Monitor (1024 x 768), • 1M VGA Card • 18Mb Shareware
*Local Bus Video Card an Extra $99
*Local Bus I/O Card an Extra $99.00

MULTIMEDIA SYSTEMS

486DX-33	486DX2-66
$2485	$2995
INC TAX $3010	INC TAX $3625

Systems include: As Above, + CD ROM, Sound Blaster & Speakers (Discovery Pack)

PRICE ONLY WITH SYSTEMS MS DOS 6.0.. $99
MS DOS 6.0 AND WINDOWS 3.1.....$149
FREE FOUR HOUR COURSE WITH EVERY SYSTEM SOLD : APPLIES ONLY IN MELBOURNE

MULTIMEDIA PRODUCTS

PERFORMANCE PACK.....$899
Sound Blaster 16 Dual speed CD ROM, Speakers, Microphone, 5 CD's

DISCOVERY PACK.....$699
Sound Blaster Pro V2 Dual Speed CD ROM, Speakers 4 CD's

PREMIUM PACK.....$1099
SoundBlaster 16, Dual Speed CD ROM, Speakers Microphone, 8 CD's

WOW!
DOS 6 UPGRADE. 5¼" only
Just $75.00 Each
Hurry! 10 Copies Only!

NEED A PRINTER OR LAPLINK CABLE WE HAVE A HUGE RANGE

SOUND BLASTER DELUXE

Digital voice channel
Voice imput (digital sampling)
Games port - MIDI interface
Built in Amplifier
FM intelligent organ
Talking Parot
Only $110.00

SOUND BLASTER PRO

20 voice, 4 operator FM
Music synthesizer
Joystick port
Built in MIDI interface
Microphone and line inputs
High performance CD ROM interface... Only $199.00

MONITORS

SUPER VGA
14" 1024x768 0.28" Dot Pitch.....$399

NON-INTERLACED
14" 1024x768, 0.28" Dot Pitch.....$479

XGA 15" 1280x1024 DIGITAL.....$729

VERBATIM DATALIFE

PLASTIC BOXES

Description	1-9	10+
3½ DS/DD	$18.95	$17.95
3½ DS/HD	$28.95	$26.95
5¼ DS/DD	$13.95	$12.95
5¼ DS/HD	$18.95	$17.95

VERBATIM DATALIFE

CARDBOARD BOXES

Description	1-9	10+
3½ DS/DD	$17.95	$16.95
3½ DS/HD	$27.95	$25.95
5¼ DS/DD	$12.95	$11.95
5¼ DS/HD	$17.95	$16.95

MATHSCO-PROCESSOR

387SX SL....$179 387DX.....$189
387DX-40....$179 387SX-40...$179
High speed modem users
16550 F.I.F.O UART.....$26.95

VGA CARDS

256K VGA 16 BIT.....$39.00
512K VGA 16 BIT.....$79.00
1 MEG VGA CARD.....$119.00

MOTHERBOARDS

386SX-41 LM 47 32K Cache..$169
386DX-40 128K Cache.....$249
NEW 386DX-40 128K Cache with Upgadable CPU socket and Local Bus Slot.....$369
486DX-33 256K Cache with upgradable CPU socket and 3 Local Bus Slot.....$795
486DX-50 256K Cache L.B..$1195
486DX2-50 256K Cache L.B.$1095
486DX2-66 256K Cache L.B.$1295
486-50 EISA.....$1795
486-33 EISA/VESA full 32 bit.$2595
YES OUR MOTHERBOARDS COME WITH CACHE RAM!

JOYSTICKS

QS - 123 WARRIOR 5
IBM Compatible (15 pin) $39.95
QS - 133
APPLE & IBM Compatible (9 & 15 pin) $39.95
AVIATOR 5
*Authentic aircraft control yoke
*Automatic control yoke centering
*Realistic Altitude / Level Indicator
.....$79.95
386 & 486 machines require additional game card.....$19.95

MORE AT OUR STORES

HARD DRIVE SPECIALS 2 Yr WTY

SEAGATE DRIVES. Ring for latest prices.

Cap	Voice.C	Av.Acc	Brand	Tax Inc.	Tax Ex.
131M	YES	16ms	SEA	$349	$288
212M	YES	16ms	WD	$379	$310
255M	YES	16ms	WD	$459	$379
345M	YES	12ms	WD	$569	$469
420M	YES	12ms	WD	$789	$651
540M	YES	12ms	SEA	$1199	$998

STUDENT SOFTWARE

Lotus 123 V4 for Windows..... $179
Lotus Freelance V2 / Windows.. $179
MS Powerpoint for Windows..... $230
MS Project for Windows..... $340
MS Publisher for Windows..... $110
MS Works for Windows $99
Norton Back-up for Windows..... $99
Norton Desktop for Windows.....$155
Quattro Pro for Windows..... $99
Wordperfect 6.0..... $189
STUDENT ID REQUIRED WHEN ORDERING

SIMMS	1-9	10+	100+
1M x 9-60	$99	$97	$95
1M x 9-70	$89	$85	$79
4M x 9-70	$309	$299	$279
4M x 9-60	$349	$339	$319

EPSON PRINTERS

STYLUS 800

Epsons new ink jet technology delivers 360 x 360 dpi text & graphics
*48-nozzle ink jet dot matrix
*180 cps LQ (12cpi)
*9 standard fonts
*Parallel port standard
*100 sheet paper cassette.....$599.00

LQ100

24 pin printer 200cps. d.s.
ONLY.....$399 or $329(ex tax)

LQ570+

24 pin printer 252cps. d.s.
ONLY.....$599 or $495(ex tax)

LX-400	9 pin	180cps	80col	$249
LX-850	9 pin	240cps	80col	$375
LQ-860	24pin	295cps	80col	$1095
LQ-870	24pin	330cps	80col	$950
LQ-1070	24pin	252cps	136col	$795
LQ-1170	24pin	350cps	136col	$1149

BULK DISK PRICES

3½" DS HD FORMATTED AND PRETESTED WITH SOFTWARE FOR DATA INTEGRITY AND RELIABILITY

ALL PRICES / BOX OF 10 - WITH LIFETIME WARRANTY. COME COMPLETE WITH WRITE PROTECT AND LABLES

DESCRIPTION	1-9	10+	50+	100+	500+
5¼ DS/DD	$4.50	$4.30	$4.30	$3.95	$3.95
5¼ DS/HD	$8.50	$7.95	$7.90	$6.90	$6.90
3½ DS/DD	$8.50	$7.95	$7.90	$6.90	$6.90
3½ DS/HD	$10.50	$9.95	$9.75	$9.50	$9.00

JAPANESE TECHNOLOGY TOP BRAND DISK DRIVES
1.44MB 3½" F.D.D.$79.00
1.2MB 5¼" F.D.D...$89.00
3½ CRADLE.....$9.95

AUTO DATA SWITCHES

These are a very economical way of networking multiple computers to a single laser printer etc. without an expensive networking system being installed.

SA4-1 Serial Auto Switch
4 x 25DB25 socket in
1 x DB25 out
X19156.....$124.95

PA4-1 Parallel Auto Switch
4 x DB25 socket in
1 x DB25 out
X19157.....$99.95

MAESTRO MODEMS

96M (ext) 9,600 baud, error correction, data compression
X19007.....$499
144M (ext) 14,400 baud, error correction, data compression
X19002.....$549

MAESTRO FAX MODEMS

RC224FM (internal) Card modem 2,400 baud data - 9,600 baud (send only) Fax.
X18990.....$249
9600XR (ext) 2,400 baud data - 9,600 baud send / receive Fax.
X19008.....$399
96FM (ext) 9,600 baud data - 9,600 baud send / receive Fax.
X18996.....$549
144FM (ext) 14,400 baud data - 14,400 baud send / receive Fax.
X19005.....$599

All modems contain Quicklink II communications software. Fax Modems also contain Quicklink II fax software.

SALE OF INKJET PRINTERS (DEMONSTRATION STOCK) IN OUR CITY STORE
48 A'BECKETT ST. MELBOURNE

GENIUS SCANNER 4500

Black. white and grey emulation scanner with powerful photo image editor and multilingual omnifont OCR. Three grey emulation modes allows you to bring exellent reproductions into your reports etc.
X19945.....$199.00

EPSON LASER PRINTIER

EPL 5200 (1 ONLY, CITY STORE)
*6p.p.m. *300 dpi *Expandable memory up to 5Mb *14 Bitmapped & 13 Scalable fonts **$1299**

RITRON

3 BUTTON MOUSE WITH 3½" SOFTWARE
$24.95

FAX ROLLS

210 x 11.5 x 30m
215 x 24.5 x 30m
210 x 25.4 x 30m

1-9	10+
$4.95	$3.95

ROD IRVING ELECTRONICS Pty. Ltd.

FOR THE SERIOUS COMPUTER USER Est. 1977 ACN 005 426 437

MELBOURNE:	48 A'Beckett St. Ph:(03) 663 6151 : Computers Ph:639 1640
OAKLEIGH:	240c Huntingdale Rd. Oakleigh. Ph: (03) 562 8939
NORTHCOTE:	423 High St. Northcote. Ph: (03) 489 8866
BOX HILL:	1031 Maroondah Hwy. Box Hill. Ph: (03) 899 6033
ADELAIDE:	241-243 Wright St. Adelaide. Ph. (08) 211 7200
SYDNEY:	74 Parramatta Rd. Stanmore. N.S.W. Ph: (02) 519 3888
MAIL ORDER:	(03) 543 7877 (local) Fax: (03) 543 8295

MAIL ORDER HOTLINE: 008 33 5757 STD ORDER

BULLETIN BOARD PH: (03) 562 7877

TAX EXEMPT SALES: Government, Corporate Sales
HEAD OFFICE: 56 Renver Rd. Clayton Ph: (03) 543 2166 Fax (03) 543 4871
OFFICE HOURS 9am - 5pm Monday - Friday

BLUESTAR COMPUTERS:
RINGWOOD: 271 Maroondah Hwy. Ringwood. (03) 870 1800 Fax:(03) 879 3027

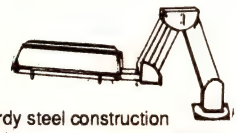
Errors and Omissions excepted. Prices subject to change without notice due to RAM CPU price availability fluctuations. IBM*, PC*, Microsoft* are all registered trademarks of their respective owners. "SILICON CHIP" DECEMBER 93

ROD IRVING ELECTRONICS

OFFICE ESSENTIALS FROM ROD IRVING ELECTRONICS

MONITOR MOVER ARMS

Position your monitor exactly where you want it. Place your monitor in the idael working position or out of the way when you're not using it.
*Maximize your desk space
*Solid steal structure
*Span 330mm
*Tray 300mm (Tilting + / - 15°)
*Desk clamp range 30 to 75mm
*Maximum loading 50Kg
WAS ~~$199.00~~ **SAVE $50**
C21079.....$149.00



*Sturdy steel construction
*Monitor mover can rotate 360°
*Lifts monitors up to 22Kg.
*Platform tray 350mm x 305mm
*Platform can swivel 360°and tilt 25°
*80mm desk clamp that can be moved up to 90°
*Locks in place with monitor on tray.
Was ~~$199~~ **Save $50**
C21082.....$149.00

ANTI GLARE SCREENS

Relieve eye strain and headaches and increase production with these Anti Glare screens.

X99995	12" Screen	**$9.95**
X99990	14" Screen	**$18.95**
X99991	15" Screen	**$59.95**
X99992	17" Screen	**$79.95**
X99993	20" Screen	**$89.95**

COPY HOLDERS

YU-H33
*Copy area 9½" x 11"
*Sliding line guide
*Flat meta! base
C21060.....$39.95

YU-H32

Ajustable arm allows easy positioning
*Copy area 9½" x 11"
*Sliding line guide
*Clamping Mounting
C21062.....$39.95

GRIP CLIP

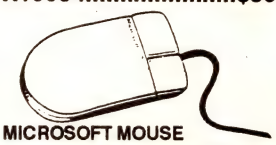
*Attaches to the top of your monitor
*Spring clip to hold paper
*Velcro at mount for easy removal
C21065.....$14.95

MICE

RITRON MOUSE
*3 button Mouse.
*100% Microsoft compatible.
*9 pin.
X19942.....$24.95

FREE MOUSE MAT & MOUSE HOUSE 100 ONLY

QUICK MOUSE
The Quick Mouse is an economical and practical aid for facilitating work with your PC. Simplify your your computer operations by using the Qucik Mouse instead of your keyboard. The keys on the mouse are optionally programable and can be used as keyboard typing or as a macro key.
Auto-selection and auto-transfer between mouse systems mode and Microsoft serial mouse mode.
*Compatible with mouse system PC and Microsoft serial mouse.
*OMRON Micro-switch, 3 button.
*Tracking speed: 600mm/sec up.
*Resolution: 200 DPI (0.12mm/dot).
*Standard RS-232 output, or 9 pin selectable.
*Quick Mouse driver test program.
*Quick Mouse pop up menu generator
*Quick Mouse manual.
*Image 72 software.
X19954.....$39.95



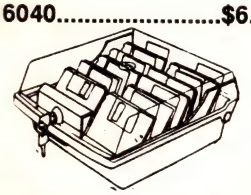
MICROSOFT MOUSE
The mouse that virtually outpoints all of them. The winner of virtually every major design and user award in the industry, the Microsoft mouse gives you fingure tip control with pinpoint accuracy, with resolution of 400 DPI. The acceleration features moves you quickly accross the screen using just a few inches of desk space. The Microsoft Mouse mouse has always been the one which all the others are judged on.
*Enhances finguretip control
*Requires less desk space
*Supports hundreds of applications
X19965 Serial.....$135.00
X19966 Bus.....$135.00

MOUSE ACCESSORIES

MOUSE HOLDER
Handy mouse holder that attaches to the of your computer or monitor for storing your mouse when it's not in use. It will accept a mouse with the demensions of 65mm wide x 35mm thick.
C21064.....$3.95

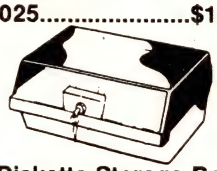
DISK BOXES

3½" Eclipse Diskette Storage Box
• Removable and Hinged Lid
• High impact anti-static base
• 40 Diskettes capacity
• 4 Dividers with tag holders
• No Lock
C16040.....$6.95



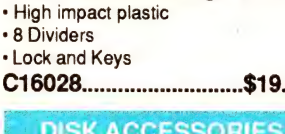
3½ Diskette Storage Box
• 100 Diskette capacity
• High impact plastic
• Lock and Keys
C16038.....$16.95

5¼ Diskette Storage box
• Durable, High-impacted plastic construction
• Holds 60 Disks
• 4 Dividers with tag holders
• Lock and keys
C16025.....$14.95



5¼ Diskette Storage Box
• High impact plastic
• 8 Dividers
• Lock and Keys
C16028.....$19.95

DISK ACCESSORIES



Floppy Locks
Privacy of documents and personal or company data in very important in todays workplace. Now there is a simple way to prent prying eyes from seeing whats on your floppy disks while your not there. It's called a "floppy lock". Just insert it into your floppy drive and turn the key, thus disabling the drive.
It is also a great way to keep the kids out of the computer. Floppy locks come in both 3½" and 5¼".
C12578 3½" lock.....**$19.95**
C12579 5¼" lock.....**$19.95**

COMPUTER STAND

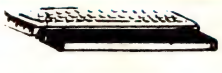
Vertical Computer Stand
Get your computer off the desk with our coputer stand.
*Adjustable width from 115mm to 188mm
Accomidates IBM PC / XT / AT and most compatibles
*Light weight and durable.
SAVE $5
C21076.....$19.95

KEYBOARD & EXTENTION LEADS

5 DIN female plug to 5 pin male plug.
*1.8 metre coiled lead.
P19038.....$9.95

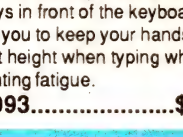
5 DIN female plug to 5 pin male plug.
*1.8 metre straight lead.
P19043.....$9.95

KEYBOARD WRIST REST



This is the product that all secretaries, word processing operators or keyboard operators have been waiting for! The wrist rest lays in front of the keyboard that allows you to keep your hands at the correct height when typing while preventing fatigue.
C21093.....$9.95

LAMINATOR



Laminate those important business cards, membership cards and even photogrphs with this laminator. Rod Irving Electronics have imported this laminator so it's within the budget.
A91100.....$79.95

Laminate Envelopes
A91110 (100) Credit card **$19.95**
A91111 (24)111 x 171 mm hole punched for folders **$12.95**
A91112 (24)108 x 157mm **$12.50**
A91113 (24) 95 x 135mm **$12.95**

ROD IRVING ELECTRONICS

NEW DUAL CD ROM DRIVES

The CD ROM drive is fast becoming a standard feature in home computers. Why? Because an average 1.2 Gigabytes of data can now e stored on a single CD using these new dual speed CD ROMs. A key component to multimedia is the CD ROM Drive as multimedia applications are data intensive and a CD is capable of holding so much information without filling up your hard drive. A CD ROM drive will also fit into any 5.25" half height dive bay on your IBM compatible (XT's not compatible.)

A range of Multimedia packages exist and are available from Rod Irving Electronics.

PERFORMANCE PACK

- SOUND BLASTER 16
- DUAL SPEED CD ROM
- MICROPHONE, SPEAKERS, VOICE ASSIST (Voice Recognition Software)
- BUNDLED CDS INCLUDE:
- SOFT TOOLWORKS ENCYCLOPEDIA
- ALDUS PHOTOSTYLER
- ANIMALS SAN DIEGO ZOO
- JUST GRANDMA & ME
- WHERE IN THE WORLD IS CARMEN SAN DIEDGO? (DELUXE)

X17140.....$899.00

X17150 (+ $150 for Sound Blaster 16 ASP)

DISCOVERY PACK

- SOUND BLASTER PRO V2
- DUAL SPEED CD ROM
- SPEAKERS
- BUNDLED CDS INCLUDE:
- SOFT TOOLWORKS ENCYCLOPEDIA
- ANIMALS SAN DIEGO ZOO
- JUST GRANDMA & ME
- WHERE IN THE WORLD IS CARMEN SAN DIEDGO? (DELUXE)

X17160.....$699.00

PREMIUM PACK

- SOUND BLASTER 16
- DUAL SPEED CD ROM
- MICROPHONE, SPEAKERS, VOICE ASSIST (Voice Recognition Software)
- BUNDLED CDS INCLUDE:
- SOFT TOOLWORKS ENCYCLOPEDIA
- ALDUS PHOTOSTYLER
- ANIMALS SAN DIEGO ZOO
- MACROMIND ACTION PRESENTATION PACKAGE
- AUTHORWARE STAR-MPC DEVELOPMENT PACKAGE
- MATHAMATIC TEMPRA • PC ANIMATE PLUS
- HSC INTERACTIVE-MPC DEVELOPMENT

X17170.....$1099.00

X17175 .....(+ $150 for Sound Blaster 16 ASP)

HUGE SAVINGS ON SOUND BLASTER CARDS

SOUND BLASTER DELUXE II

The Sound Blaster Deluxe is the ultimate sound board that easily plugs into any slot in your IBM, PC, XT, AT, 386 etc.

- Text to Speech synthesizer
- 11 Vice FM music synthesizer
- Built-in joystick port
- Built-in stereo Power amplifier
- Digitized Voice output with 4 KHz to 44, 1KHz Sampling rate.
- Digitized voice input (8 Bit Analogue to Digital conversion)
- Built-in Midi Interface for connecting Musical instruments
- Bundled software includes: Sbtalker for reading ASCII files & Dr Sbaitso
- Voxkit Voice development toolkit for recording • Sounds talking, Parrot mimics your speech • FM Intelligent organ creates orchestra like music using your PC keyboard as input. • Jukebox - A Windows three application • Creative wave studio • Creative talk Scheduler • Creative Mosaic.

3.½" Version Now

X17080.....$110.00

SPEAKERS.....$10.00 EXTRA

SOUND BLASTER PRO DELUXE

X17082 Now Just.....$199.00

SOUND BLASTER 16 ASP

*16-bit CD-quality stereo sound sampling and playback with auto dynamic filtering ensures low noise and crystal-clear recording
* Enhanced 4-operator, 20-voice FM music synthesizer with realistic instrument sounds
* ASP (Advanced Signal Processing) technology for downloading and performance complex algorithms
* Improved stereo digital mixer with 10 channels, 32x2dB steps, tone control and recording input mixer
* MIDI interface: MPU-401 UART and Sound Blaster modes
* CD-ROM interface
* Joystick port
* Wave Blaster Upgrade Option: Daughterboard that expands your music synthesis horizon to the professional level
* Compatible with Sound Blaster, Windows 3.1, MPC and OS/2 2.0
* Includes a full library of professional software

X17065.....$469.00

ALSO AVAILABLE

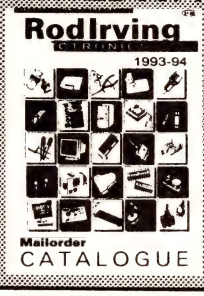
Dual Speed CD-ROM & aldus Photostyler CD (for use with Sound Blaster Pro, Pro V2, SB 16, SB16-ASP) X17180.....$599.00

Dual Speed CD-ROM, Conroller & Aldus Photostyler CD (for use with SB, Thunderboard, Adlib, Sound Commander & others) X17190.....$699.00

ROD IRVING ELECTRONICS

GREAT CHRISTMAS PRESENT IDEAS FROM ROD IRVING ELECTRONICS

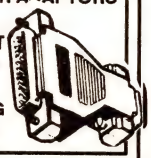
OUR NEW 148 PAGE CATALOGUE IS OUT NOW COME INTO ANY OF OUR STORES AND PICK UP YOUR FREE COPY !



GENDER CHANGES

9 PIN TO 25 PIN CONNECTOR ADAPTORS

	1 - 9	10 +
DB9 PLUG TO DB25 SOCKET X15668	$9.95	$8.95
DB9 SOCKET TO DB25 PLUG X15668	$9.95	$8.95



NEW PARADISE TURBO ACCELERATOR

- *Hardware-assisted cursor and bit block transfer accelerate the performance of Windows and windowing programs.
- *Easy hardware and software installation.
- *Includes software that lets you quickly change screen resolutions.
- *1 MByte of on board memory.
- *Resolution up to 1280 x 1024.
- *Supports 256 colours.
- *Supports VESA 72Hz Refresh rate for flicker-free sceen.
- *Refresh rate adjustment.
- *Featuring connector for 8514/A adaptor
- *Windows 3.1 compatible
- *One year warranty - Technical help line.

	640 x 480	800 x 600	1024 x 768	1280 x 1024
16 Col	*	*	*	*
256 Col	*	*	*	

X18180.....$185.00

HUGE SAVINGS ON MOST PRODUCTS COME IN AND SAVE ON THOUSANDS OF ITEMS

SUPER SPECIALS

FROM OUR MAIN WAREHOUSE

1 MEG SIPPS
LIMITED STOCK ONLY $59.00

SCANNERS

SCANPLUS 600

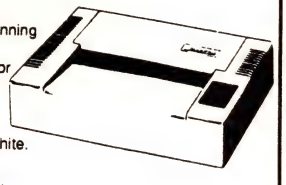
FULL PAGE GREY SCALE SCANNER

600 DPI, One pass Full Page Scale scanner. The SG600 makes the perfect choice for Desktop publishing, OCR and Electronic Document Filing. A must for Fax card owners. 16 Bit interface card supplied overcomes typical system clashes with other interface cards.
Complete with TWAIN drivers data and power cables.
BONUS - Supplied with Picture Publisher LE.
X17110.....$699.00

SCANPLUS
COLOUR 6000

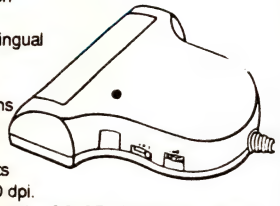
ScanPlus is a full-page, 24 bit colour scanner that supports up to 16.8 Million colours. The ScanPlus Colour 6000 allows you to incorperate full-colour photographs, graphics and long pages of text into your imaging, publishing and word processing system.

FEATURES:
*IBM PC / AT / 386 / 486, PS / 2 & Macintosh compatible.
*Full page 216mm (8½") max. scanning width.
*High speed (one pass scanning for RGB), high resolution (600 dpi).
*HP ScanJet IIc emulated driver
*Four scanning modes:
24-bit, 8-bit grey, halftone, black/white.
*Supports most popular software, including DTP, IMAGE, PRESENT, OCR Packages and most popular faxcards.



ScanPlus includes everything you need to start scanning.
*Full page colour scanner and power cord.
*interface unit and cable.
*Colour image capturing software and User's guide.
X17120.....$999.00

GENIUS SCANNER 4500



Black white and grey emulation scannner with powerful photo/Image Editor and multilingual Omnifont OCR. Three grey emulation modes allows you to bring excellent reproductions of pictures into your reports, brochures, etc. Perfect for scanning line art. Scan objects in resolutions from 100 to 400 dpi.
GO-CR. This package includes the GO-CR. Optical Character Recognition (OCR) program. GO-CR scans programs into computer readable text files. The multilingual capabilities allowsyou to recognise documents in any one of 80 languages. GO-CR is the supreme PC typist! Edit enhance and design professional quiality with iPhoto Deluxee. Combine images from several scans. It can even convert your black and white photos to true grey scale formatto ease its Windows based operation makes the power of this professional utility accessable to everyone.
X19945.....$199.00

KITS....KITS....KITS

FILL IN THOSE SPARE HOURS BUILDING USEFUL AND ENTERTAINING KITS. FROM SIMPLE TO CHALLANGING. THERE IS SURE TO BE ONE IN OUR LARGE RANGE TO SUIT YOU!

CAT	Description	R.R.P
K10005	SOLAR VOLTAGE REGULATOR	$13.95
K10040	ETI 480 50W AMP	$27.95
K10045	ETI 480 100W AMP	$34.95
K10050	ETI 480 POWER SUPPLY	$28.95
K10055	GENERAL PURPOSE PRE-AMPLIFIER	$14.95
K10060	BALANCED MICROPHONE AMPLIFIER	$12.95
K10065	GENERAL PURPOSE AMPLIFIER	$14.95
K10070	BALANCED INPUT DIFFERENTIAL PREAMP	$19.95
K10075	FLOAT NICAD CHARGER	$14.95
K10080	TRANSISTOR TESTER	$22.95
K10085	300W PLAYMASTER AMP	$119.00
K10095	2 TONE ALARM	$9.95
K10100	1.5V TO 9V DC CONVERTER	$13.95
K10105	3 DIGIT COUNTER	$23.95
K10110	ELECTRIC FENCE	$23.95
K10115	ELECTRIC FENCE CONTROLLER	$61.95
K10120	TV PATTERN GENERATOR	$109.00
K10125	UNIVERSAL POWER SUPPLY	$12.95
K10130	DISCO LIGHT	$165.00
K10135	LED SCANNER	$17.95
K10140	LOW FUEL INDICATOR FOR CAR	$11.95
K10145	SCREECHER CAR ALARM	$36.95
K10150	12/24V LIGHT CHASER	$21.95
K10155	LOW VOLTAGE CUTOUT FOR CAR / BOAT	$22.95
K10200	50 MHz DIGITAL FREQUENCY	$149.5
K10205	VHF POWERMATCH	$74.95
K10215	TEMPERATURE PROBE FOR MULTIMETERS	$19.95
K10225	18V / 1AMP BENCH TOP POWER SUPPLY	$79.95
K10295	LOW OHMS METER	$29.95
K10300	TEMPERATURE ADAPTOR	$24.95
K10305	VOICE OPERATED RELAY	$19.95
K10310	IGNITION KILLER	$22.95
K10315	HEADPHONE AMP	$34.95
K10320	VIDEO RF MODULATOR	$17.95
K10325	50W AUDIO AMPLIFIER	$54.95
E10325	P.C.B FOR K10325	$19.95
K10330	RS232 FOR COMMODORE 64	$24.95
K10335	RGB TO PAL ENCODER MODULE	$49.95
K10340	CAMCORDER MIXER	$29.95
K10345	KARAOKE BOX	$27.95
K10350	REMOTE CONTROL EXTENDER	$32.95
K10355	HIGH ENERGY IGNITION	$55.00
K10360	LOUDSPEAKER PROTECTOR	$29.95
K10365	NICAD BATTERY DISCHARGER	$27.95
K10370	PORT. 12V LEAD ACID BATTERY CHARGER	$27.95
K10380	1GHz DIGITAL FREQUENCY COUNTER	$147.95
K10390	LOW COST QUIZ GAME AJUDICATOR	$34.95
K10395	MESSAGE RECORDER	$65.95
K10400	WOOFER STOPPER	$55.95
K10405	COLOUR VIDEO FADER	$32.95
K10410	FM WIRELESS MICROPHONE	$19.95
K10415	EPROM PROGRAMMER	$99.50
K10440	18/36 W HIGH EFFICIENCY FLURO INVERT KIT	$78.95

LAPLINK CABLES

Laplink serial combination
9 & 25 pin F - F 2 Metres
P19070.....$34.95

Laplink parallel cable
DB25 pin M - M 2 Metres
P19070.....$34.95

ROD IRVING ELECTRONICS. Est. 1977. 100% Australian Owned & Run

ACN 005 426 437

- **HEAD OFFICE**: 56 RENVER RD CLAYTON. PH: (03) 543 7877. FAX: (03) 543 2648.
- **CITY**: 48 A'BECKETT ST, MELBOURNE. PH: (03) 663 6151 / (03) 639 1640. FAX: (03) 639 1641.
- **OAKLEIGH**: 240C HUNTINGDALE RD, OAKLEIGH. PH: (03) 562 8939 FAX: (03) 562 8940
- **NORTHCOTE**: 423 HIGH ST, NORTHCOTE. PH: (03) 489 8866. FAX: (03) 489 8131.
- **BOX HILL**: 1031 MAROONDAH HWY, BOX HILL. PH: (03) 899 6033 FAX: (03) 899 0156.
- **SYDNEY**: 74 PARRAMATTA RD, STANMORE. PH: (02) 519 3888. FAX: (02) 516 5024.
- **ADELAIDE**: 241-243 WRIGHT ST. ADELAIDE. PH: (08) 211 7200 FAX: (08) 211 7273.

BLUESTAR COMPUTERS: (COMPUTER PRODUCTS ONLY)
• 271 MAROONDAH HWY. RINGWOOD.
PH: (03) 870 1800. FAX: (03) 879 3027.

• **TOLL FREE MAIL ORDER HOTLINE: 008 33 5757.**
FAX ORDERS: (03) 543 2648 (STRICTLY ORDERS ONLY)
• **RIE BULLETIN BOARD**: (03) 562 7877 For Specials, Info & more.

MAIL ORDER & CORRESPONDENCE :
Bag 620, Rosebank MDC,
Clayton South. Victoria, 3169.

ALL TAX EXEMPT SALES TO:
RITRONICS WHOLESALE: 56 Renver Rd, Clayton, Victoria.
Ph: (03) 543 2166 Fax: (03) 543 2648

TOLL FREE MAIL ORDER HOTLINE: 1800 33 5757.

RIE BULLITEN BOARD FOR SPECIALS, INFO AND SERVICE (03) 562 7903

Build this:

1-Chip Melody Generator

This simple project produces a 64-note melody using just a 3-pin IC in a TO-92 plastic package, plus a few external parts. Six different ICs are available to give six different melodies, whilst a seventh chip produces a medley of tunes.

By BERNIE GILCHRIST

TABLE 1 shows the range of melody and medley ICs that are available for this project. A separate kit can be constructed for each melody required or the melody can be changed simply by swapping the IC. It should also be possible to change ICs using a 2-pole 2-position switch.

Power for the circuit is derived from a single 1.5V cell but there is provision for an external 3-12V supply as well. The sound level produced by the small loudspeaker specified is quite impressive and can be reduced if necessary, as described later.

At the heart of this project is a UM66TxxL low-power CMOS IC, part of a series designed for use in door bells, telephones and toys. This IC is an LSI (large scale integration) device which includes a ROM (read only memory) that is programmed with the note scales and rhythm codes. The oscillator and control circuitry is also built into the chip.

The output from IC1 is a modulated rectangular waveform which is almost equal to the supply voltage in amplitude; ie, slightly less than 1.5V peak-to-peak. The required sound is achieved by varying the frequency and width of the pulses.

The output from IC1 appears at pin 1 and drives transistors Q1 and Q2 which operate as a Darlington o stage to drive an 8Ω loudspeake sistor R2 is used for supply vol greater than 3V and protects bot and the loudspeaker from excess rent (see Table 2).

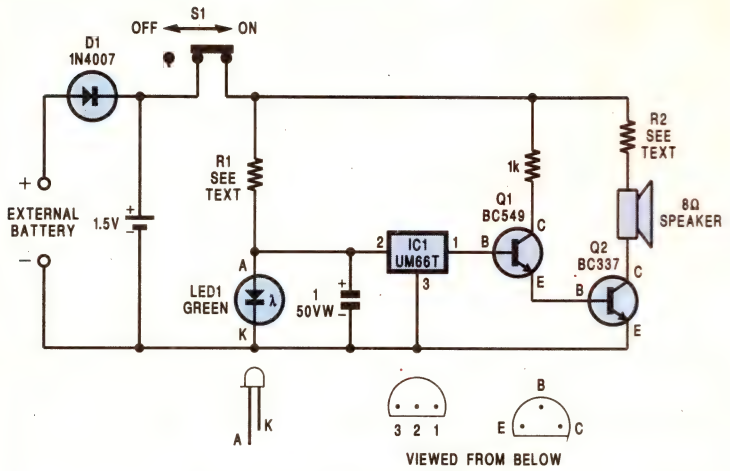
The 1µF electrolytic capacitor nected between Vdd (pin 2) and (pin 3) is used to decouple the su to IC1. This prevents the relati high switching current in the ou stage from interfering with the op tion of the IC.

D1, R1, R2 and LED 1 are used c if the supply voltage is 3V or m These parts can be omitted if the cuit is to be powered from a 1 battery and R1 and R2 replaced wire links. D1 protects the circui the external supply voltage is ac dentally reversed, while R1 and L 1 together form a 2.3V regulator limit the supply voltage to the IC (3. max).

Table 2 shows the suggested valu for R1 and R2 for external supp voltages of 3-12V. Note that the 1.5 battery must be removed if you inter using an external supply.

Assembly

Fig.2 shows the parts layout on th PC board (code ZA-1324). You ca install the parts in any order but b



MELODY GENERATOR

Fig.1: the melody is generated by IC1 & this drives Darlington output pair Q1 & Q2 which in turn drive the loudspeaker.

PARTS LIST

1 PC board, code ZA-1324, 78 x 33mm
1 8-ohm 0.2W loudspeaker
1 AA single cell battery holder
1 SPDT slide switch
1 countersunk screw & nut (to secure battery holder)

Semiconductors
1 UM66TxxL melody generator IC (IC1) - see Table 1.
1 BC549 NPN transistor (Q1)
1 BC337 NPN transistor (Q2)
1 1N4007 silicon diode (D1)
1 5mm green LED (LED 1)

Capacitors
1 1µF 50VW PC electrolytic

Resistors (0.25W, 5%)
1 1kΩ
1 R1 - see Table 2
1 R2 - see Table 2

Where to buy the kit
This project was designed by Dick Smith Electronics who own the copyright on the PC board. Complete kits are available from all Dick Smith Electronics Stores or by mail order from PO Box 321, North Ryde, NSW 2113. The price is $9.95 plus $3 p&p. Please quote the relevant catalog number when ordering – see Table 1.

TABLE 1

IC Type	Melody(s)	Catalog Number
UM66T01L	Jingle Bells + Santa Claus is Coming To Town + We Wish You A Merry Christmas	K-5502
UM66T05L	Home Sweet Home	K-5504
UM66T09L	Wedding March (Mendelssohn)	K5506
UM66T19L	For Elise	K-5508
UM66T32L	Waltz	K-5510
UM66T33L	Mary Had A Little Lamb	K-5512

ure to use the correct part at each ocation. Use wire links for R1 and R2 f you are going to power the circuit rom a 1.5V battery, otherwise refer to Table 2 for the values of these components.

Note that using a link for R2 will give the maximum output from the speaker but the battery life will be quite short. Alternatively, you can increase the battery life at the expense of output level by installing a low value resistor for R2 (eg, 10Ω).

Take care when mounting the transistors. Do not push them too far down into the board because the leads spread and this may damage the connections inside them.

Check that all polarised parts have been oriented correctly before applying power. These include the diode, transistors, IC, LED and the electrolytic capacitor. The LED leads are easy to identify – the cathode (K) lead is the shorter of the two.

Although LED 1 is not intended to operate as a power indicator, it could also be used for this purpose if you are using an external (3V or greater) supply. All you have to do is reduce the value of R1 so that the LED current is about 5-10mA. The values shown for R1 in Table 2 give a current of about 1mA (ie, not enough to light the LED), so just divide the value shown for a given voltage to obtain the current required. Do not use a red LED for LED 1, as its forward voltage drop will be only about 1.8V (as opposed to 2.3V for a green LED).

Once all the parts are in, install the battery and switch on. If everything is correct, the circuit will immediately start playing back the tune programmed into IC1. If it doesn't, switch off immediately and check for wiring errors. **SC**

TABLE 2

Supply	R1	R2
1.5V	link	link
3V	560 ohms	link
6V	3.3k	10 ohms 1W
9V	6.8k	22 ohms 1W
12V	8.2k	27 ohms 5W

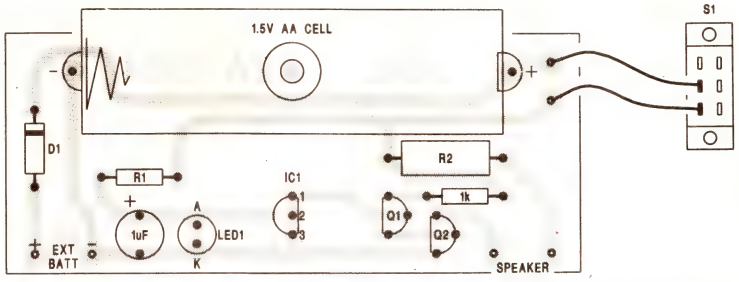


Fig.2: this wiring diagram shows all parts in position but note that some parts can be left out if power comes from a 1.5V battery.

Silicon Chip BACK ISSUES

September 1988: Hands-Free Speakerphone; Electronic Fish Bite Detector; High Performance AC Millivoltmeter, Pt.2; Build The Vader Voice; Motorola MC34018 Speakerphone IC Data; What Is Negative Feedback, Pt.4.

November 1988: 120W PA Amplifier Module (Uses Mosfets); Poor Man's Plasma Display; Automotive Night Safety Light; Adding A Headset To The Speakerphone; How To Quieten The Fan In Your Computer; Diesel Electric Locomotives.

December 1988: 120W PA Amplifier (With Balanced Inputs), Pt.1; Diesel Sound Generator; Car Antenna/Demister Adaptor; SSB Adaptor For Shortwave Receivers; Why Diesel Electrics Killed Off Steam; Index to Volume 1.

March 1989: LED Message Board, Pt.1; 32-Band Graphic Equaliser, Pt.1; Stereo Compressor For CD Players; Amateur VHF FM Monitor, Pt.2; Signetics NE572 Compandor IC Data; Map reader For Trip Calculations; Electronics For Everyone – Resistors.

April 1989: Auxiliary Brake Light Flasher; Electronics For Everyone: What You Need to Know About Capacitors; Telephone Bell Monitor/ Transmitter; 32-Band Graphic Equaliser, Pt.2; LED Message Board, Pt.2.

May 1989: Electronic Pools/Lotto Selector; Build A Synthesised Tom-Tom; Biofeedback Monitor For Your PC; Simple Stub Filter For Suppressing TV Interference; LED Message Board, Pt.3; All About Electrolytic Capacitors.

June 1989: Touch-Lamp Dimmer (uses Siemens SLB0586); Passive Loop Antenna For AM Radios; Universal Temperature Controller; Understanding CRO Probes; LED Message Board, Pt.4.

July 1989: Exhaust Gas Monitor (Uses TGS812 Gas Sensor); Extension For The Touch-Lamp Dimmer; Experimental Mains Hum Sniffers; Compact Ultrasonic Car Alarm; NSW 86 Class Electric Locomotives.

September 1989: 2-Chip Portable AM Stereo Radio (Uses MC13024 and TX7376P) Pt.1; Alarm-Triggered Telephone Dialler; High Or Low Fluid Level Detector; Simple DTMF Encoder; Studio Series 20-Band Stereo Equaliser, Pt.2; Auto-Zero Module for Audio Amplifiers (Uses LMC669).

October 1989: Introducing Remote Control; FM Radio Intercom For Motorbikes Pt.1; GaAsFet Preamplifier For Amateur TV; 1Mb Printer Buffer; 2-Chip Portable AM Stereo Radio, Pt.2; Installing A Hard Disc In The PC.

November 1989: Radfax Decoder For Your PC (Displays Fax, RTTY & Morse); FM Radio Intercom For Motorbikes, Pt.2; 2-Chip Portable AM Stereo Radio, Pt.3; Floppy Disc Drive Formats & Options; The Pilbara Iron Ore Railways.

December 1989: Digital Voice Board (Records Up To Four Separate Messages); UHF R Switch; Balanced Input & Output Stages; For The LM831 Low Voltage Amplifier IC; I ing A Clock Card In Your Computer; Ind Volume 2.

January 1990: High Quality Sine/Square Os tor; Service Tips For Your VCR; Speedin Your PC; Phone Patch For Radio Amateurs tive Antenna Kit; Speed Controller For C Fans; Designing UHF Transmitter Stages.

February 1990: 16-Channel Mixing Desk; Quality Audio Oscillator, Pt.2; The Incredible Canaries; Random Wire Antenna Tuner F Metres; Phone Patch For Radio Amateurs, I PC Program Calculates Great Circle Bearing

March 1990: 6/12V Charger For Sealed Le Acid Batteries; Delay Unit For Automatic An nas; Workout Timer For Aerobics Classes; Channel Mixing Desk, Pt.2; Using The UC3 SLA Battery Charger IC.

April 1990: Dual Tracking ±50V Power Supp VOX With Delayed Audio; Relative Field Stren Meter; 16-Channel Mixing Desk, Pt.3; Active Filter For Weak Signal Reception; How To F Vintage Radio Receivers From The 1920s.

June 1990: Multi-Sector Home Burglar Alar Low-Noise Universal Stereo Preamplifier; Lo Protection Switch For Power Supplies; A Spe Alarm For Your Car; Design Factors For Moc Aircraft; Fitting A Fax Card To A Computer.

July 1990: Digital Sine/Square Generator, Pt (Covers 0-500kHz); Burglar Alarm Keypad & Cor bination Lock; Simple Electronic Die; Low-Co Dual Power Supply; Inside A Coal Burning Pow Station; Weather Fax Frequencies.

August 1990: High Stability UHF Remote Trans mitter; Universal Safety Timer For Mains Appl ances (9 Minutes); Horace The Electronic Cricke Digital Sine/Square Wave Generator, Pt.2.

September 1990: Music On Hold For Your Tel

Use this handy form to order your back issues

Please send me a back issue for:

❑ March 1989	❑ April 1989	❑ September 1988	❑ November 1988	❑ December 1988
❑ September 1989	❑ October 1989	❑ May 1989	❑ June 1989	❑ July 1989
❑ February 1990	❑ March 1990	❑ November 1989	❑ December 1989	❑ January 1990
❑ August 1990	❑ September 1990	❑ April 1990	❑ June 1990	❑ July 1990
❑ January 1991	❑ February 1991	❑ October 1990	❑ November 1990	❑ December 1990
❑ June 1991	❑ July 1991	❑ March 1991	❑ April 1991	❑ May 1991
❑ November 1991	❑ December 1991	❑ August 1991	❑ September 1991	❑ October 1991
❑ April 1992	❑ May 1992	❑ January 1992	❑ February 1992	❑ March 1992
❑ September 1992	❑ October 1992	❑ June 1992	❑ July 1992	❑ August 1992
❑ February 1993	❑ March 1993	❑ November 1992	❑ December 1992	❑ January 1993
❑ July 1993	❑ August 1993	❑ April 1993	❑ May 1993	❑ June 1993
		❑ September 1993	❑ October 1993	❑ November 1993

Enclosed is my cheque/money order for $_____or please debit my: ❑ Bankcard ❑ Visa Card ❑ Master Card

Card No. | | | | | | | | | | | | | | | | |

Signature _____ Card expiry date_____ /_____

Name _____

Street _____

Suburb/town _____ Postcode _____

Note: all prices include post & packing

Australia (by return mail) $A7
NZ & PNG (airmail) $A7
Overseas (airmail) $A10

Detach and mail to:
Silicon Chip Publications, PO Box 139, Collaroy, NSW, Australia 2097.

Or call (02) 979 5644 & quote your credit card details. Fax (02) 979 6503.

ne; Remote Control Extender For VCRs; er Supply For Burglar Alarms; Low-Cost 3- Counter Module; Simple Shortwave Con- r For The 2-Metre Band.

ober 1990: Low-Cost Siren For Burglar ms; Dimming Controls For The Discolight; sound Simulator; DC Offset For DMMs; The gers of Polychlorinated Biphenyls; Using The 502 In Home-Brew Converter Circuits.

vember 1990: How To Connect Two TV Sets One VCR; A Really Snazzy Egg Timer; Low- st Model Train Controller; Battery Powered er Pointer; 1.5V To 9V DC Converter; Intro- tion To Digital Electronics; Simple 6-Metre ateur Transmitter.

cember 1990: DC-DC Converter For Car Am- iers; The Big Escape – A Game Of Skill; Wiper lser For Rear Windows; Versatile 4-Digit Com- nation Lock; 5W Power Amplifier For The 6- etre Amateur Transmitter; Index To Volume 3.

nuary 1991: Fast Charger For Nicad Batteries, .1; Have Fun With The Fruit Machine; Two- one Alarm Module; Laser Power Supply; LCD eadout For The Capacitance Meter; How Quartz rystals Work; The Dangers When Servicing Mi- owave Ovens.

ebruary 1991: Synthesised Stereo AM Tuner, t.1; Three Inverters For Fluorescent Lights; Low- Cost Sinewave Oscillator; Fast Charger For Nicad Batteries, Pt.2; How To Design Amplifier Output Stages; Tasmania's Hydroelectric Power System.

March 1991: Remote Controller For Garage Doors, Pt.1; Transistor Beta Tester Mk.2; Synthe- sised AM Stereo Tuner, Pt.2; Multi-Purpose I/O Board For PC-Compatibles; Universal Wideband RF Preamplifier For Amateurs & TV.

April 1991: Steam Sound Simulator For Model Railroads; Remote Controller For Garage Doors, Pt.2; Simple 12/24V Light Chaser; Synthesised AM Stereo Tuner, Pt.3; A Practical Approach To Amplifier Design, Pt.2; Playing With The Ansi.Sys File; FSK Indicator For HF Transmissions.

May 1991: 13.5V 25A Power Supply For Trans- ceivers; Stereo Audio Expander; Fluorescent Light Simulator For Model Railways; How To Install Multiple TV Outlets, Pt.1; Setting Screen Colours On Your PC.

June 1991: A Corner Reflector Antenna For UHF TV; 4-Channel Lighting Desk, Pt.1; 13.5V 25A Power Supply For Transceivers; Active Filter For CW Reception; Electric Vehicle Transmission Op- tions; Tuning In To Satellite TV, Pt.1.

July 1991: Battery Discharge Pacer For Electric Vehicles; Loudspeaker Protector For Stereo Am- plifiers; 4-Channel Lighting Desk, Pt.2; How To Install Multiple TV Outlets, Pt.2; Tuning In To Satellite TV, Pt.2; PEP Monitor For Amateur Trans- ceivers.

August 1991: Build A Digital Tachometer; Mast- head Amplifier For TV & FM; PC Voice Recorder; Tuning In To Satellite TV, Pt.3; Installing Win- dows On Your PC; Step-By-Step Vintage Radio Repairs.

September 1991: Studio 3-55L 3-Way Loud- speaker System; Digital Altimeter For Gliders & Ultralights, Pt.1; Build A Fax/Modem For Your Computer; The Basics Of A/D & D/A Conversion; Windows 3 Swapfiles, Program Groups & Icons.

October 1991: Build A Talking Voltmeter For Your PC, Pt.1; SteamSound Simulator Mk.II; Mag- netic Field Strength Meter; Digital Altimeter For Gliders & Ultralights, Pt.2; Getting To Know The Windows PIF Editor.

November 1991: Colour TV Pattern Generator, Pt.1; Battery Charger For Solar Panels; Flashing Alarm Light For Cars; Digital Altimeter For Gliders & Ultralights, Pt.3; Build A Talking Voltmeter For Your PC, Pt.2; Modifying The Windows INI Files.

December 1991: TV Transmitter For VCRs With UHF Modulators; Infrared Light Beam Relay; Solid- State Laser Pointer; Colour TV Pattern Generator, Pt.2; Windows 3 & The Dreaded Unrecoverable Application Error; Index To Volume 4.

January 1992: 4-Channel Guitar Mixer; Adjust- able 0-45V 8A Power Supply, Pt.1; Baby Room Monitor/FM Transmitter; Automatic Controller For Car Headlights; Experiments For Your Games Card; Restoring An AWA Radiolette Receiver.

February 1992: Compact Digital Voice Recorder; 50-Watt/Channel Stereo Power Amplifier; 12VDC/ 240VAC 40-Watt Inverter; Adjustable 0-45V 8A Power Supply, Pt.2; Designing A Speed Control- ler For Electric Models.

March 1992: TV Transmitter For VHF VCRs; Studio Twin Fifty Stereo Amplifier, Pt.1; Thermo- static Switch For Car Radiator Fans; Telephone Call Timer; Coping With Damaged Computer Directories; Valve Substitution In Vintage Radios.

April 1992: Infrared Remote Control For Model Railroads; Differential Input Buffer For CROs; Stu- dio Twin Fifty Stereo Amplifier, Pt.2; Understand- ing Computer Memory; Aligning Vintage Radio Receivers, Pt.1.

May 1992: Build A Telephone Intercom; Low- Cost Electronic Doorbell; Battery Eliminator For Personal Players; Infrared Remote Control For Model Railroads, Pt.2; A Look At Large Screen High Resolution Monitors; OS2 Is Really Here; Aligning Vintage Radio Receivers, Pt.2.

June 1992: Multi-Station Headset Intercom, Pt.1; Video Switcher For Camcorders & VCRs; Infra- red Remote Control For Model Railroads, Pt.3; 15-Watt 12-240V Inverter; What's New In Oscillo- scopes?; A Look At Hard Disc Drives.

July 1992: Build A Nicad Battery Discharger; 8- Station Automatic Sprinkler Timer; Portable 12V SLA Battery Charger; Off-Hook Timer For Tele- phones; Multi-Station Headset Intercom, Pt.2.

August 1992: Build An Automatic SLA Battery Charger; Miniature 1.5V To 9V DC Converter; Dummy Load Box For Large Audio Amplifiers; Internal Combustion Engines For Model Aircraft; Troubleshooting Vintage Radio Receivers.

September 1992: Multi-Sector Home Burglar Alarm; The Interphone Digital Telephone Ex- change, Pt.2; General-Purpose 3½-Digit LCD Panel Meter; Track Tester For Model Railroads; Build A Relative Field Strength Meter.

October 1992: 2kW 24VDC To 240VAC Sine- wave Inverter; Multi-Sector Home Burglar Alarm, Pt.2; Mini Amplifier For Personal Stereos; Elec- tronically Regulated Battery Charger (Charges 6V, 12V & 24V Lead-Acid Batteries).

November 1992: MAL-4 Microcontroller Board, Pt.1; Simple FM Radio Receiver; Infrared Night Viewer; Speed Controller For Electric Models, Pt.1; 2kW 24VDC To 240VAC Sinewave Inverter, Pt.2; Automatic Nicad Battery Discharger.

December 1992: Diesel Sound Simulator For Model Railroads; Easy-To-Build UHF Remote Switch; MAL-4 Microcontroller Board, Pt.2; Speed Controller For Electric Models, Pt.2; 2kW 24VDC To 240VAC Sinewave Inverter, Pt.3; Index To Volume 5.

January 1993: Peerless PSK60/2 2-Way Hifi Loudspeakers; Flea-Power AM Radio Transmit- ter; High Intensity LED Flasher For Bicycles; 2kW 24VDC To 240VAC Sinewave Inverter, Pt.4; Speed Controller For Electric Models, Pt.3.

February 1993: Three Simple Projects For Model Railroads; A Low Fuel Indicator For Your Car; Audio Level/VU Meter With LED Readout; Build An Electronic Cockroach; MAL-4 Microcontroller Board, Pt.3; 2kW 24VDC To 240VAC Sinewave Inverter, Pt.5; Making File Backups With LHA & PKZIP.

March 1993: Build A Solar Charger For 12V Bat- teries; An Alarm-Triggered Security Camera; Low- Cost Audio Mixer for Camcorders; Test Yourself On The Reaction Trainer; A 24-Hour Sidereal Clock For Astronomers.

April 1993: Solar-Powered Electric Fence; Build An Audio Power Meter; Three-Function Home Weather Station; 12VDC To 70VDC Step-Up Volt- age Converter; Digital Clock With Battery Back- Up; A Look At The Digital Compact Cassette.

May 1993: Nicad Cell Discharger; Build The Woofer Stopper; Remote Volume Control For Hifi Systems, Pt.1; Alphanumeric LCD Demonstra- tion Board; Low-Cost Mini Gas Laser; The Micro- soft Windows Sound System.

June 1993: Windows-Based Digital Logic Ana- lyser, Pt.1; Build An AM Radio Trainer, Pt.1; Re- mote Control For The Woofer Stopper; A Digital Voltmeter For Your Car; Remote Volume Control For Hifi Systems, Pt.2; Double Your Disc Space With DOS 6.

July 1993: Build a Single Chip Message Re- corder; Light Beam Relay Extender; Build An AM Radio Trainer, Pt.2; Windows Based Digital Logic Analyser; Pt.2; Low-Cost Quiz Game Adjudicator; Programming The Motorola 68HC705C8 Micro- controller – Lesson 1; Antenna Tuners – Why They Are Useful.

August 1993: Low-Cost Colour Video Fader; 60- LED Brake Light Array; A Microprocessor-Based Sidereal Clock; The Southern Cross Z80-based Computer; A Look At Satellites & Their Orbits; Unmanned Aircraft – Israel Leads The Way; Ghost Busting For TV Sets.

September 1993: Automatic Nicad Battery Charger/Discharger; Stereo Preamplifier With IR Remote Control, Pt.1; In-Circuit Transistor Tester; A +5V to ±15V DC Converter; Remote-Controlled Electronic Cockroach; Restoring An Old Valve Tester; Servicing An R/C Transmitter, Pt.1.

October 1993: Courtesy Light Switch-Off Timer For Cars; FM Wireless Microphone For Musi- cians; Stereo Preamplifier With IR Remote Con- trol, Pt.2; Electronic Engine Management, Pt.1; Mini Disc Is Here; Programming The Motorola 68HC705C8 Microcontroller – Lesson 2; Servic- ing An R/C Transmitter, Pt.2.

November 1993: Jumbo Digital Clock; High Effi- ciency Inverter For Fluorescent Tubes; Stereo Preamplifier, Pt.3; Build A Siren Sound Genera- tor; Electronic Engine Management, Pt.2; More Experiments For Your Games Card; Preventing Damage To R/C Transmitters & Receivers.

PLEASE NOTE: all issues from November 1987 to August 1988, plus October 1988, January, Feb- ruary & August 1989, and May 1990 are now sold out. All other issues are presently in stock, al- though stocks are low for some older issues. For readers wanting articles from sold-out issues, we can supply photostat copies (or tearsheets) at $6.00 per article (incl. p&p). When supplying pho- tostat articles or back copies, we automatically supply any relevant notes & errata at no extra charge.

AMATEUR RADIO

BY GARRY CRATT, VK2YBX

Selective tone calling in commercial & amateur radio

Signalling systems designed & used in commercial communications are now finding their way into amateur communications. This article sets out to explain the difference between the various commonly used systems & why different systems exist.

The use of a signalling system can greatly improve the efficiency of a communications system, by allowing many users to operate on the same communications frequency without causing interference. A signalling system thus allows greater utilisation of the RF spectrum.

A multitude of signalling systems already exist around the world, ranging from very simple single tone or sub-audible tone systems to sophisticated computer-controlled proprietary systems. However, most commonly encountered systems in use in Australia fall into the following categories.

CTCSS signalling

The Continuous Tone Controlled Squelch System, or CTCSS as it is commonly known, is a system whereby an RF carrier is modulated with a continuous audio tone, in addition to speech. Originally known as Tone Squelch, modern systems now utilise tones in the low frequency range, from 67Hz to 250.3Hz (see Table 1).

When the modulated carrier signal is received, a decoder detects the particular tone in use and uses it to unmute the receiver. In this way, transmissions using a different tone, or no tone, are ignored by a CTCSS equipped receiving station. The CTCSS tone is filtered out in the receiver, prior to the audio stage.

This system is widely used in simplex commercial radio systems, where it may be necessary to selectively call base stations, other mobiles, or operate various remote receiver functions. As the system is operating on a shared frequency basis, it is important to ensure that the channel is free before transmitting, in order to minimise interference caused by simultaneous transmissions from a number of mobile stations.

One of the disadvantages of CTCSS is that, due to the very nature of the tones used, repeater operation in CTCSS mode is often unreliable or impossible. This is because most transceivers are designed to deliberately roll off the audio response outside th speech range, particularly belo 300Hz. Modern commercial repeate specifically designed for CTCSS op erations employ special decoding ci cuitry for this purpose.

In addition, CTCSS tones are nc compatible with the DTMF tones use in phone patch operations.

Nevertheless, some form of signal ling through repeaters is necessary and a signalling system known as SELCALL is often used. This system comprises a range of discrete audio frequencies, each corresponding to a digit from 0-9, plus two extra tones for "repeat", where adjacent tones are identical, and "group" signalling, where a number of mobiles are to be called simultaneously.

Table 1: CTCSS Codes

67.0	94.8	131.8	171.3	203.5
69.4	97.4	136.5	173.8	206.5
71.9	100.0	141.3	177.3	210.7
74.4	103.5	146.2	179.9	218.1
77.0	107.2	151.4	183.5	225.7
79.7	110.9	156.7	186.2	229.1
82.5	114.8	159.8	189.9	233.6
85.4	118.8	162.2	192.8	241.8
88.5	123.0	165.5	196.6	250.3
91.5	127.3	167.9	199.5	

5-tone sequential tone sets

The 5-tone principle has been accepted internationally by a number of leading standard associations such as CCIR, EIA, ZVEI, NATEL and EEA.

As can been seen from Table 2, while the broad principle has been adopted, there are a number of sequential tone sets in use around the world, as dictated by the appropriate standard association.

Selective calling also facilitates ANI and Group calling through repeaters. Automatic number identification (ANI) is used to indicate that a call has been received at an unattended mobile radio. As the transceiver initiating the call is equipped with a unique 5-tone code, it is a relatively simple matter to store and display the code, revealing the identity of the sender and time of transmission at the unattended end of the radio link. In addition, the signalling system can be

Table 2: Tone Sequential Standard

one	CCIR	EEA	EIA	ZVEI-1	ZVEI-2	ZVEI-3
0	1981	1981	600	2400	2400	2200
1	1124	1124	741	1060	1060	970
2	1197	1197	882	1160	1160	1060
3	1275	1275	1023	1270	1270	1160
4	1358	1358	1164	1400	1400	1270
5	1446	1446	1305	1530	1530	1400
6	1540	1540	1446	1670	1670	1530
7	1640	1640	1587	1830	1830	1670
8	1747	1747	1728	2000	2000	1830
9	1860	1860	1869	2200	2200	2000
R*	2110	2110	459	2600	970	2400
G*	2400	1055	2151	2800	885	2600
ITPS*	100ms	40ms	33ms	70ms	70ms	70ms

Note: R = Repeat tone; G = Group tone; ITPS = International Tone Period Standard

Table 3: DTMF Signalling Frequencies

		High Group Frequencies (Hz)			
		1209	1336	1477	1633
Low Group Frequencies (Hz)	697	1	2	3	A
	770	4	5	6	B
	852	7	8	9	C
	941	*	0	#	D

used to activate an audio alarm, indicating "call received" status.

Group calling allows a base operator to call a group of mobiles, without disturbing other mobiles on the same frequency, and preserves some degree of security.

DTMF signalling

DTMF or "touch tone" signalling is commonly used in amateur circles to gain or restrict access to repeaters. In addition, the use of the standard DTMF (dual tone multi frequency) tones, as shown in Table 3, allows easy interconnection to the PSTN telephone network, a great advantage for those utilising phone patch interconnect equipment.

In fact, commercial trunked radio transceivers use DTMF signalling so that the very basis for their existence (interconnection to the PSTN as a competitor to the AMPS cellular network) is easily achieved.

However, there are particular disadvantages in using DTMF signalling in the mobile radio environment. Table 3 shows the combinations of two tones required to produce a DTMF "digit". The difference in level between the two tones must be held to specific limits to ensure accurate signalling. The maximum allowable "twist" of these tones is 4dB (AUSTEL standard TS-002) in Australia and 3dB in New Zealand. In an RF environment, this twist level can normally only be guaranteed to within 6dB, making the system unreliable.

Also, the minimum achievable signal to noise ratio in a DTMF system can be mathematically calculated to be at least 6dB worse than that achieved by a 5-tone sequential system, because in a DTMF system, the deviation per tone is only half that used in a 5-tone system. There are a number of other disadvantages with DTMF radio signalling in areas such as speed, timing, dynamic range and intermodulation products.

Digital coded squelch

A further development in signalling technology is the DCS or "digital coded squelch" system, where each of a group of codes corresponds to a digital TTL data stream sent typically as an 8-bit word, either in bursts or continuously. Unlike analog tone systems, the advantage of a digital system is the enormous number of mobiles that can be operated on the one frequency. Some commercial users are currently operating 250 DCS mobile transceivers on the one frequency!

Table 4 shows a list of the commonly used 104 DCS codes. Each code corresponds to a specific data stream.

Table 4: DCS Codes

023	131	251	371	532
025	132	252	411	546
026	134	255	412	565
031	143	261	413	606
032	145	263	423	612
036	152	265	431	624
043	155	266	432	627
047	156	271	445	631
051	162	274	446	632
053	165	306	452	654
054	172	311	454	662
065	174	315	455	664
071	205	325	462	703
072	212	331	464	712
073	223	332	465	723
074	225	343	466	731
114	226	346	503	732
115	243	351	506	734
116	244	356	516	743
122	245	364	523	754
125	246	365	526	

Pocket pagers

Although not a signalling system used in 2-way communications, the POCSAG code system used in pocket pagers is certainly worth mentioning as an advanced one-way signalling system. In 1975, the British Post Office established the Post Office Code Standardisation Advisory Group to study and design a digital radiopaging message format. Two years later, that group recommended what is today called POCSAG.

Understanding this system requires a good working knowledge of Boolean algebra and is beyond the scope of this article. Suffice to say, POCSAG is the predominant paging signalling system in use in the world today.

One interesting piece of test equipment we discovered whilst working on this article is the "CD-1 Communications Decoder Unit", a stand-alone tone decoder capable of displaying CTCSS, DCS and DTMF signalling tones received by radio. Designed as an accessory for a service monitor, this unit can easily be wired to any receiver and used to display signalling codes in use. The unit is available from Raedale Pty Ltd in Queensland. Telephone (075) 76 3000.

The most obvious use is the monitoring of unauthorised users of commercial repeaters. No doubt there is a similar application to which the unit could be put in amateur radio.

Signalling Technology Pty Ltd of Melbourne (phone 03 786 0077) also stock a useful range of encoding and decoding products. **SC**

SILICON CHIP

ORDER FORM

BACK ISSUES

MONTH	YEAR	MONTH	YEAR	PRICE EACH (includes p&p)	TOTAL
				Australia (by return mail) $A7 NZ & PNG (airmail) $A7 Overseas (airmail) $A10	$A

BINDERS

Please send me _____ SILICON CHIP binder(s) at $A14.95 each (incl. postage within Australia). NZ & PNG orders please add $A5.00 each for postage. Not available elsewhere. **$A**

SUBSCRIPTIONS

❑ New subscription – month to start_____

❑ Renewal – Sub. No._____ ❑ Gift subscription ☞

RATES (please tick one)	2 years (24 issues)	1 year (12 issues)
Australia	❑ $A90	❑ $A49
Australia with binder(s)*	❑ $A114	❑ $A61
NZ & PNG (airmail)	❑ $A135	❑ $A72
Overseas surface mail	❑ $A135	❑ $A72
Overseas airmail	❑ $A240	❑ $A120

*1 binder with 1-year subscription; 2 binders with 2-year subscription

GIFT SUBSCRIPTION DETAILS

Month to start_____

Message_____

_____

_____

Gift for:
Name_____
(PLEASE PRINT)

Address_____

_____

State_____Postcode_____

YOUR DETAILS

Your Name_____
(PLEASE PRINT)

Address_____

_____Postcode_____

Daytime Phone No._____ **Total Price $A** _____

Signature

_____

❑ Cheque/Money Order ❑ Bankcard ❑ Visa Card ❑ Master Card

Card No. | | | | | | | | | | | | | | | | |

Card expiry date_____/_____

Phone (02) 979 5644
9am-5pm Mon-Fri.
Please have your credit card details ready

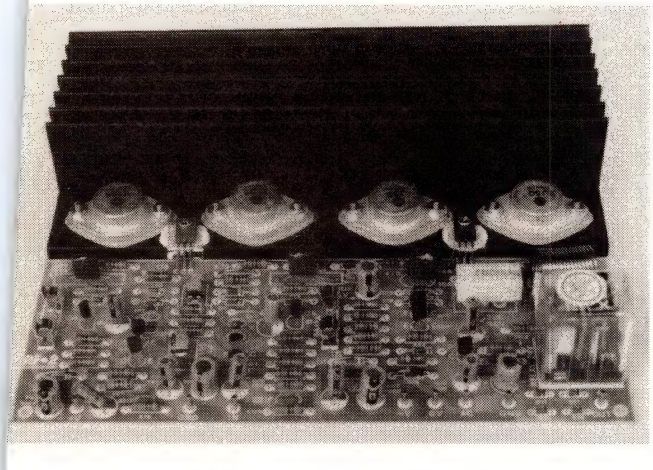
OR

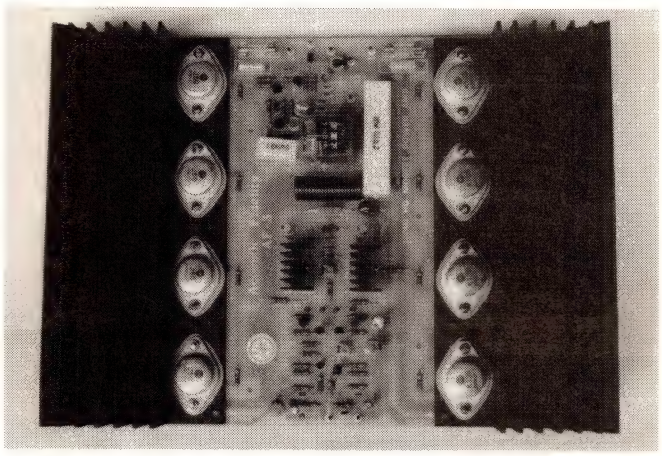
Fax (02) 979 6503
Fax the coupon with your credit card details
24 hours 7 days a week

OR

Mail coupon to:
Freepost 25
Silicon Chip Publications
PO Box 139, Collaroy 2097
No postage stamp required in Australia

PRODUCT SHOWCASE





Power amplifier modules from A-One

A-One Electronics has specialised in ready-built audio modules for some time and these two are from the top of their Acoustic Fidelity range. First up is a 250 watt power amplifier module featuring Hitachi 2SJ50 and 2SK135 complementary Mosfets. The input has a trimpot for minimising the DC offset at the output and a heavy duty relay is used to switch the loudspeaker load.

This is a high performance amplifier, with a frequency response flat to within ±0.8dB from 3Hz to 20kHz and a rated harmonic distortion of less than 0.03%. Depending on the power transformer used, power output is a maximum of 150 watts RMS into 8Ω or 250 watts into 4Ω. The AF-2 module (Cat S-0342) is well priced at $228.00.

For those wanting higher power again, look no further than the AF-3 module which is rated at 300 watts. It is essentially the same entirely complementary circuit as in the AF-2 module but with higher supply rails and four each of the Hitachi 2SK135 and 2SJ50 Mosfets. The specifications are the same as before except that the power is upped to 200 watts into 8Ω and 300 watts into 4Ω.

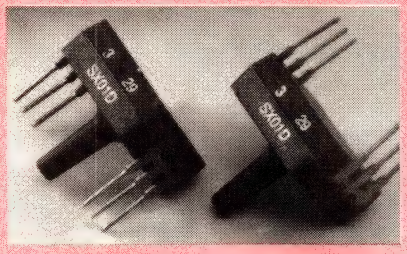
Price of the AF-3 (Cat S-0343) module is $299.00. Both modules are rug-

Solid-state pressure sensors

SenSym has introduced a new DIP package that will accommodate any of its various pressure sensor die. This small package will allow for assembly onto a PC board via automatic insertion equipment. The package will also conserve board space, since it measures only 0.47 by 0.55 inch with the spacing between the rows of mounting pins only 600 mils.

One configuration will allow for 0.5-inch board spacing. The package will support pressure ranges from 4-inches H_2O full scale to 100 psi full scale and is available in absolute, gauge or differential configurations.

These packages were specifically designed for electronic equipment



that requires the measurement and control of pressure. Many such applications exist in the medical field (ventilators, spirometers and respirators), as well as in pneumatic controls.

Pricing will depend upon the type of sensor die and pressure range but will be competitive with other low-cost SenSym sensors. For more information, contact NSD Australia, 205 Middleborough Rd, Box Hill, Vic 3128. Phone (03) 890 0970.

AUDIOPHILES!

Now high audiophile quality components & kits are available in Australia. Buy direct & save.

*Kimber, Wonder, Solen & MIT Capacitors

*Alps Pots *Holco resistors *High Volt. Cap.

*Gold Terminals & RCA *WBT Connectors

*Kimber Cables * Interconnect Cables

*Output Transformers (standard or customised)

*Power Transformers *Semiconductors

*Audio Valves & Sockets *Wonder Solder

*Welborne Labs Accessories

Valve & Solid State Pre-Power Amplifier Kits

*Contan Stereo 80 Valve Power Amp. (As per Elect. Aust. Sept. & Oct. '92)

*Welborne Labs Hybrid Preamp. & Solid State Power Amplifier

Send $1.00 for Product Catalog

PHONE & FAX: (03) 807 1263

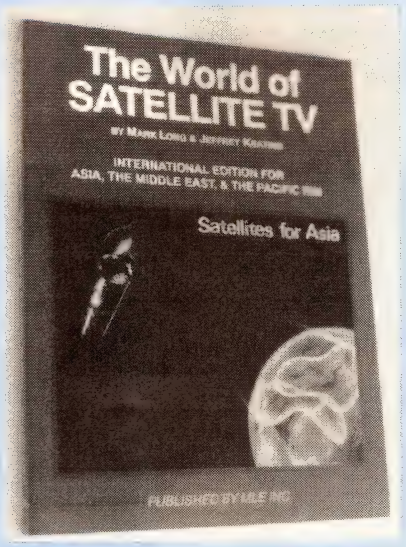
CONTAN AUDIO

37 WADHAM PARADE
MT. WAVERLEY, VICTORIA 3149.

Australasian satellite TV book

Written by Mark Long and Jeffrey Keating, "The World of Satellite TV" gives a comprehensive description of the technology involved in the delivery of satellite TV. It also explains why some installations need big dishes and gives actual footprints and transponder loadings for satellites in our region.

This second edition of "The World of Satellite TV" has been accepted by many as the best satellite book available. It can be purchased from Dick Smith Electronics, Jaycar Electronics or Peter C. Lacey for $29.90 plus $5 pack and postage. The Australian distributor is Peter C. Lacey Services Pty Ltd, 80 Dandenong Road, Frankston, Vic 3199. Phone (03) 783 2388.



ged circuits with the well-proven Hitachi Mosfets. Get into them while they last. They're available at A-One Electroncis Pty Ltd, 432-434 Kent Street, Sydney NSW 2000. Phone (02) 267 4819.

Low cost 15-bit 4-channel A/D card

Boston Technology Pty Ltd has announced the Australian release of the LLAD 140 15-bit 4-channel A/D card for PC/XT/AT/386/486 and compatible computers.

The LLAD 140 analog interface has four differential analog input channels, each with 0.25mV resolution over an input range of ±5 volts, with excellent stability and noise immunity. Standard linearity is 0.005%. Reproducibility is ±1 count or better. Readings are accurate to within .025% of full scale at normal operating temperatures, and 7.5 conversions performed per second. Input impedance is 1GΩ and inputs are protected against over-voltages to 200V. There also a 4-bit isolated output port provided.

The LLAD 140 is a 2/3-length c and comes supplied complete w user manual and utility disc. Interf ing is via a DB-15 connector locat on the end of the board.

For more information, contact B ton Technology Pty Ltd, PO Box 17 North Sydney, NSW 2059. Phone (0 955 4765.

Low cost PC board prototypes

A new PC board manufacturin service has been set up to meet th demand for small volumes of qualit double-sided, through-hole plate boards.

By adopting the latest disposabl photo-tooling techniques, Don Ala has managed to almost eliminate tool ing costs. The resulting prices wil challenge breadboarding techniques for prototypes and one-off manufacturing. Don claims that prices will range from a quarter of the usual price of other PC board manufacturers.

All PC boards are 1.6mm fibreglass, double-sided, through-hole plated, 35µm copper (1 oz), solder resist and component overlayed. Non rectangular and internal profiles and cutouts

Southern Cross Z80 Computer – ctd from p.68

nects the 10-pin IDC socket with the 25-pin Centronics sub-D male connector using 10-strand flat cable. The other cable connects the 28-pin EPROM socket on the target system to the 28-pin EPROM socket on the emulator board.

Two identical 28-pin DIP plug connectors have to be connected to either end of the 28-strand flat ribbon cable. You need to decide on the cable length which should ideally be no more than 200mm long. The method of making these cables is described above.

The parallel port cable has eight connections as listed in Table 2.

Make the 10-pin IDC socket connector first. To do this, match cable strand 1 (usually hatched red colour) to the triangle pin 1 moulded in the IDC socket. Press the socket together, then lay out the cable and the 25-pin male sub-D connector in front of you. Find pin 1 of the IDC connector and solder the other end of the wire to pin 18 of the sub-D connector. Work through pins 2-8 of the 10-pin IDC connector and solder in all eight connections to the sub-D connector as outlined in Table 2.

Remember that pin 2 of the IDC header is strand three of the ribbon cable, pin 3 is strand five, pin 4 is strand seven, etc. Finally, fit the sub-D cover onto the 25-pin connector to relieve the strain on the solder connections.

Does it work?

Connect the EPROM emulator to the Southern Cross computer and to your PC and power both systems up. Type 'em scmv1_2.hex' on the PC keyboard. The Data LED should light up on the emulator for about second, then the Ready LED should turn on, the buzzer should sound and '2000' should appear in the Address displays on the Southern Cross (you may have to press the Reset button).

If this is OK, enter 'em 3digit.hex'. Go to Address 1800 and press Function 0. A 3-digit count should be displayed on the right three displays. It should be possible to increase or decrease the readout with the "+" and "-" keys respectively.

All the procedures and software for the emulator are supplied on a floppy disc which comes with the kit. The designers suggest that the emulator software be used in conjunction with a program such as Norton Commander for most efficient creation of code for the Southern Cross. SC

available. All artwork must be a tel Easytrax or Autotrax file.

A free design kit is available that ludes a hole size guide, Protel ytrax (Freeware) PC board layout tware for the PC, a program that ecks and quotes your PC board file, sign data and a tutorial for those o are using a computer to lay out boards for the first time.

Files may be delivered by 1200 or 00 Baud modem, 24 hours a day – odem number (08) 373 5489.

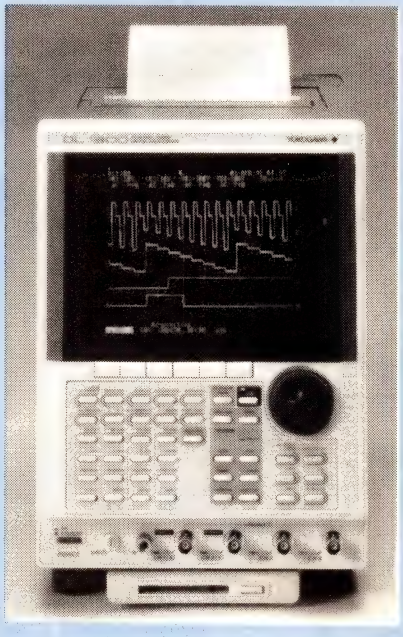
For further information, contact onald Kay, Don Alan Electronics, O Box 404, Brooklyn Park, SA 5032. hone (08) 43 3957.

New Scope desoldering tool

This useful new solder sucker from Scope Laboratories uses a tough see-through plastic casing which helps you see when to clean out the excess solder. It features a self-cleaning replaceable nozzle and a vacuum capacity of 9ml. It is available from your nearest Scope stockist.

For further information, contact Scope Laboratories, PO Box 63, Niddrie, Victoria 3042. Phone (03) 338 1566.

100MHz digital storage oscilloscope



Featuring sampling speeds of 100Ms/sec on two channels in single shot mode, or 10Gs/sec on all four channels in repetitive mode, the DL1300A offers up to double the sampling speed of Yokogawa's DL1200A model by increasing the acquisition memory to 64K per channel.

A fast screen update rate allows the DL1300A to display incoming waveforms in real time, while simultaneously displaying up to a 1000 times expanded segment of the same waveform, also in real time. The display is a high resolution amber raster scan CRT. Several levels of brightness allow adjustable contrast between waveforms, measurements and the screen grid.

The standard DL1300A is provided with a GPIB interface, external trigger, and clock interface which allows synchronisation of the timebase to an external signal such as a data clock or shaft encoder.

Options for the DL1300A include a thermal printer, an RS232C communications port and a memory card interface which can store and recall front panel setup and waveform data. A video option is also available and this allows a standard video monitor to display the DL1300A screen.

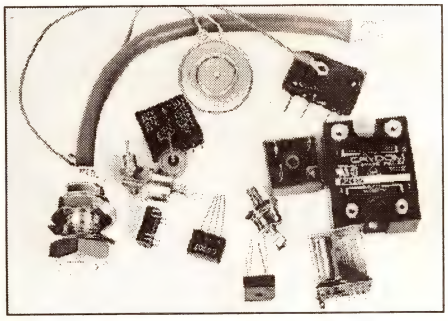
Automatic measurement facilities are also provided, including RMS voltage, peak to peak voltage, frequency and rise/fall times. Two channels may also be tested by a GO/NO-GO function, with the result causing waveform capture or an automatic hard copy printout.

For further information, contact Tony Richardson, Yokogawa Australia Pty Ltd, Centrecourt D3, 25-27 Paul St North, North Ryde, NSW 2113. Phone (02) 805 0699.

POWER PRODUCTS!

We offer CONVENIENCE — let us source and quote your POWER ELECTRONICS. Saves you TIME and MONEY. Delivery is from stock, or on short lead time. Here's a sample of the products we support:

RELAYS
- PCB MOUNT
- SOLDER TAB
- SOCKET MOUNT
- POWER RELAYS
- CONTACTORS
- LATCHING
- IMPULSE
- ROTARY
- REED
- AUTOMOTIVE
- SOLID STATE
- TIME DELAY
- CIRCUIT BREAKERS
- I/O MODULES



POWER SEMICONDUCTORS
- PHASE CONTROL THYRISTORS (to 1900A)
- FAST THYRISTORS (to 1000 Amps)
- ASYMMETRIC THYRISTORS
- TRIACS (to 50 Amps)
- POWER DIODES (to 350 Amps)
- HOCKEY PUK DIODES (to 5800 Amps)
- HIGH VOLTAGE DIODES & STICKS (to 200 Kv)
- DIODE & THYRISTOR MODULES (to 285A)
- SINGLE PHASE BRIDGE RECT. (to 55A)
- THREE PHASE BRIDGE RECT. (to 160A)
- TRANSISTOR MODULES (to 400 Amps)

ALSO — POWER RESISTORS to 750 Watts, ELECTRON TUBES — magnetrons, thyratrons, ignatrons, klystrons...MICROWAVE PRODUCTS — hexalators, circulators, gunn diodes, mixers, detectors...WORLD-WIDE INDUSTRIAL VALVE/TUBE SOURCING.

ALL ELECTRONIC COMPONENTS
118 LONSDALE ST, MELBOURNE VIC 3000.
PH: (03) 662 3506 FAX: (03) 663 3822

FOR MORE INFORMATION PLEASE CONTACT
(03) 662 3506

Index to Volume 6: January-December 1993

Features

01/93 1 Silicon Chip 5th Birthday Sweepstakes
01/93 79 Panasonic's Super-Quiet Dot Matrix Printer
02/93 1 Silicon Chip 5th Birthday Sweepstakes
02/93 6 Microwave Disinfection of Medical Waste
02/93 14 Sony's New 8mm Video Camera
03/93 4 Sanyo's Big Screen Video Projector
03/93 16 Sony's New VGP-G700 Colour Video Printer
04/93 6 The Digital Compact Cassette
04/93 21 Silicon Chip 5th Birthday Sweepstakes
05/93 4 Hifi Review: Dynaudio Image 4 Loudspeakers
05/93 16 The Microsoft Windows Sound System
06/93 6 Dick Smith's Trans-Australia Balloon Attempt
07/93 4 The Keck Optical Telescope, Pt.1
07/93 18 Tektronix TDS 320 100MHz Digital Scope
07/93 22 Programming the Motorola 68HC705C8, Lesson 1
07/93 26 Data: The ISD1016 Voice Recorder IC
08/93 4 Ghost-Busting for TV Sets Now Feasible
08/93 6 The Keck Optical Telescope, Pt.2
09/93 4 Swiss Railways' Fast New Locomotives
09/93 53 Test Equipment Review: The Handyscope
10/93 4 Darwin to Adelaide on Solar Power
10/93 16 Mini Disc Is Here!
10/93 28 Review: Magnet LS-621 2-Way Loudspeakers
10/93 80 Programming The Motorola 68HC705C8, Lesson 2
11/93 8 Review: Tektronix TDS 544A Colour Oscilloscope
11/93 53 The World Solar Challenge
11/93 72 Review: Epson's Stylus 800 Inkjet Printer
11/93 80 Review: The Autoplex Unimeter
12/93 4 Sound Blaster Grows Up!
12/93 40 Data On The LM1875 20W Audio Amplifier IC
12/93 53 Programming The Motorola 6HC705C8, Lesson 3
12/93 92 Index to Volume 6

Electrical Energy

01/93 82 Pt.22: The Balmain & Ultimo Power Stations
04/93 08 Pt.23(a): Winning The White Metal – The Story Of Aluminium
05/93 86 Pt.23(b): Winning The White Metal – The Story Of Aluminium
06/93 88 Pt.24: How Aluminium Is Refined

Engine Management

10/93 08 Pt.1: The Advantages Of Electronic Control
11/93 04 Pt.2: Airflow Measurement
12/93 08 Pt.3: Changing The ECM Software – Chip Re-Writing

Vintage Radio

01/93 32 Restoring A 1920s Kit Radio
02/93 96 The Awakening Of The Dragon
03/93 84 Paper Capacitors Cause Lots Of Trouble
04/93 88 Restoring An Old Radio Chassis
05/93 56 A Few Old Receivers From The 1920s
06/93 56 A Look At High Tension Filtering
07/93 86 In The Good Ol' Days Of My Childhood
08/93 62 How To Deal With Block Capacitors
09/93 86 Restoring An Old Valve Tester
10/93 94 Those Never-Ending Repair Problems
11/93 82 The Vexed Question Of Originality
12/93 70 My No-Hassles Vintage Radio Museum

Serviceman's Log

01/93 44 Samsung CB15F; Acer MM211 Computer Monitor; Samsung VB711 VCR
02/93 64 Thorn 9007; Acer MM211 Computer Monitor; Panasonic NV-G22A VCR (G Mechanism)
03/93 42 Samsung CB349Z; Teac MV307 VCR; Hitachi VT-640E VCR
04/93 32 National TC-1809; HMV B4803/ Rank Arena D1 Chassis
05/93 40 National Panasonic TC-2690/ M14 Chassis
06/93 30 Grundig ST-70/460; Cintel IMD
07/93 30 Samsung CB-5012Z; Samsung CB-518F
08/93 40 Panasonic 2970V; High Energy Ignition System
09/93 40 Akai CTK-107; Teac MV-400 VCR
10/93 58 Panasonic TC-48P10; Sanyo/ 79P Chassis
11/93 34 Hanimex CTV-10; AWA AV47 VCR; Sharp VC-8300 VCR; Sharp Cassette Deck
12/93 56 Samsung CB-3325J; Hitachi Cassette Deck; Philips KT2A-2 Chassis; General Electric Portable Colour TV

Remote Control

01/93 66 Installing & Adjusting The Low-Cost Speed Controller, Pt.3
04/93 53 Practical Applications For The Low-Cost Speed Controller
05/93 53 Unmanned Aircraft – The Ultimate In Remote Control
06/93 80 Unmanned Aircraft – The Early Developments
07/93 80 Unmanned Aircraft – Current Models In Service
08/93 53 Unmanned Aircraft – Israel Leads The Way
09/93 82 Servicing Your R/C Transmitter – The Basics, Pt.1
10/93 86 Servicing Your R/C Transmitter, Pt.2
11/93 42 Preventing Damage To R/C Transmitters & Receivers
12/93 42 Servicing Your R/C Receiver – The Basics

Computer Bits

02/93 42 File Backups Plus A Useful Utility For LHA & PKZIP
04/93 64 Upgrading To A 386 – Now I Know What A "Kludge" Is
05/93 64 Upgrading To A 386 – More On Kludging A Computer
06/93 71 Double Your Disc Space With DOS 6
10/93 34 Using DOS 6.0's DoubleSpace
11/93 70 More Experiments For Your Games Card

Amateur Radio

01/93 88 Remote Monitoring Of Radio Transmissions
03/93 81 A General-Coverage Shortwave Receiver From England

ojects to Build

3 16 Peerless PSK60/2 2-Way Hifi Loudspeakers
)3 26 Build A Flea-Power AM Radio Transmitter
)3 40 High-Intensity LED Flasher For Bicycles
)3 58 A 2kW 24VDC to 240VAC Sinewave Inverter, Pt.4
93 16 Build The Electronic Cockroach
93 26 Three Simple Projects For Model Railroads
'93 38 A Low Fuel Indicator For Your Car
/93 46 The MAL-4 Microcontroller Board, Pt.3
/93 56 Audio Level/VU Meter With LED Readout
/93 80 A 2kW 24VDC To 240VAC Sinewave Inverter, Pt.5
3/93 20 Build A Solar Charger For 12V Batteries
3/93 32 An Alarm-Triggered Security Camera
3/93 50 Low-Cost Audio Mixer For Camcorders
3/93 57 Test Yourself On The Reaction Trainer
)3/93 74 A 24-Hour Sidereal Clock For Astronomers
)4/93 14 A Solar-Powered Electric Fence
)4/93 22 Build An Audio Power Meter
04/93 37 Three-Function Home Weather Station
04/93 56 12VDC to 70VDC Step-Up Voltage Converter
04/93 80 A Digital Clock With Battery Back-Up
05/93 20 A Nicad Cell Discharger
05/93 26 Build The Woofer Stopper
05/93 32 Remote Volume Control For Hifi Systems
05/93 64 Alphanumeric LCD Demonstration Board
05/93 70 A Low-Cost Mini Gas Laser
06/93 12 Build An AM Radio Trainer
06/93 18 Remote Control For The Woofer Stopper
06/93 24 A Digital Voltmeter For Your Car
06/93 36 Windows-Based Digital Logic Analyser
06/93 64 Remote Volume Control For Hifi Systems, Pt.2
07/93 32 Build A Single Chip Message Recorder
07/93 38 Light Beam Relay Extender
07/93 53 Build An AM Radio Trainer, Pt.2
07/93 60 Windows-Based Digital Logic Analyser, Pt.2
07/93 70 A Low-Cost Quiz Game Adjudicator
08/93 18 Low-Cost Colour Video Fader
08/93 30 A Microprocessor-Based Sidereal Clock
08/93 56 Build A 60-LED Brake Light Array
08/93 82 The Southern Cross Computer
09/93 16 Automatic Nicad Battery Charger
09/93 24 Stereo Preamplifier With IR Remote Control
09/93 34 Build a +5V to ±12V DC Converter
09/93 56 An In-Circuit Transistor Tester
09/93 72 Remote-Controlled Electronic Cockroach
10/93 30 Courtesy Light Switch-Off Timer For Cars
10/93 40 Stereo Preamplifier With IR Remote Control, Pt.2
10/93 57 A Solid State Message Recorder
10/93 66 FM Wireless Microphone For Musicians
10/93 70 Build A Binary Clock
11/93 16 Build A Jumbo Digital Clock
11/93 26 High Efficiency Inverter For Fluorescent Tubes
11/93 56 Stereo Preamplifier With Remote Control, Pt.3
11/93 64 Build A Siren Sound Generator
12/93 16 Remote Controller For Garage Doors
12/93 22 Build This Low-Voltage LED Stroboscope
12/93 32 A Low-Cost 25W Amplifier Module
12/93 62 Peripherals For The Southern Cross Z80 Computer
12/93 80 Build This 1-Chip Melody Generator

05/93 82 Kenwood's Mighty Little TH-28A & TH-78A Transceivers
06/93 53 The Smith Chart – What It Is & How To Use It
07/93 84 Antenna Tuners: Why They Are Useful
08/93 72 A Look At Satellites & Their Orbits
09/93 60 Emtron's ENB-2 Noise Bridge
10/93 68 Judging Receiver Performance
12/93 84 Selective Tone Calling In Commercial & Amateur Radio

Circuit Notebook

01/93 8 LED VU Scanner Display
01/93 9 Parking Lights Reminder
01/93 9 Cable Tester With LED Indicators
01/93 9 Simple Tester For IR Remote Controls
02/93 24 Horn Blower For Mobile Telephones
02/93 24 Square Wave Frequency Doubler
02/93 25 Simple Way To Make PC Boards
02/93 25 Robotics Interface For PCs
03/93 24 A 20-Metre Direct Conversion Receiver
03/93 24 Blown Fuse Indicator
03/93 25 Simple 2-Input Logic Gate Identifier
04/93 72 Breakerless Pick-Up For Car Ignition
04/93 72 Dynamic Noise Reduction Circuit
04/93 73 VFO Controlled Transmitter For 80 Metres
05/93 8 Interface For The LCD Panel Meter
05/93 8 Seven Day Hose Controller
06/93 10 Add-On Circuit For A Sidereal Clock
06/93 10 Battery Monitor For Solar Chargers
06/93 10 Refinement For The Interphone Exchange
06/93 11 Repeater Time-Out Indicator
06/93 11 Discrete Step-Down Voltage Converter
07/93 16 Battery Charge Status Monitor
07/93 16 Single-Chip Combination Lock
07/93 17 Pulser Probe For TTL & CMOS
07/93 17 Low-Cost Piezo Screamer Siren
08/93 28 Low-Cost Isolation Amplifier
08/93 28 Low Distortion Oscillator
08/93 29 Phase Adapter For Digital Multimeters
09/93 10 Wide Range Phase Control
09/93 10 Regulator For Solar Panels
09/93 11 Microcontroller Timer
10/93 24 RF-Linked IR Remote Control Extender
10/93 25 Electronic Mousetrap Catches 'Em Alive
10/93 25 Electronic Starter For Fluorescent Lights
11/93 40 Low-Cost Controller For Model Trains
11/93 40 6/12V Gel Cell Charger
11/93 41 Flash Meter
11/93 41 Power Supply Pre-Regulator Circuit
12/93 36 Single Chip Touch Switch
12/93 36 240V Motor Speed Control

Notes & Errata

01/93 100 Automatic Nicad Battery Discharger, November 1992
01/93 100 Low-Cost Speed Controller, November 1992
01/93 100 High-Current 0-20V Power Supply, December 1992
01/93 100 Stereo AM Tuner, Feb-April 1991
02/93 101 Studio Twin 50 Amplifier, March-April 1992
03/93 92 LED Flasher for Bicycles, January 1993
04/93 93 High Energy Ignition System, May, June 1988, May 1990
04/93 93 Audio Mixer For Camcorders, March 1993
05/93 92 Traffic Light Simulator, February 1993
06/93 94 Woofer Stopper, May 1993
07/93 94 Nicad Cell Discharger, May 1993
09/93 94 Colour Video Fader, August 1993
09/93 94 Studio Twin 50 Stereo Amplifier, April-May 1992
09/93 94 Amateur Radio, August 1993

ASK SILICON CHIP

Got a technical problem? Can't understand a piece of jargon or some technical principle? Drop us a line and we'll answer your question. Write to: Ask Silicon Chip, PO Box 139, Collaroy Beach, NSW 2097.

IF generator is nifty

Your design for the IF signal generator on page 58 of the July 1993 issue of SILICON CHIP will be a major asset for my service bench. I wish to make mine on a piece of stripboard, just like most of the other small bits of test equipment I have made. All of these work OK and I hope this one does too. However, I have discovered an anomaly with your published PC board layout, in respect to the position of the 1.5kΩ resistor feeding ICIc and ICId. Can you please clarify this.

I think that this "radio trainer" is a great idea. I am reminded of the crystal sets I used to make and it seems to me a pity that the children of this day will not know of these things. I guess a good follow-up would be an FM trainer?

Your Vintage Radio column is excellent! I still work with these "monsters" and love every minute of it. However, I wonder if anyone has considered a course in "antique" musical equipment, with particular reference to guitar amplification? I have restored about 10 of these so far (almost exclusively "Fender" amplifiers), much to the delight of their owners, who always seem to say "I've never heard it sound so good".

There must be hundreds of these around and there are many still in use today, much treasured by the fact that only they can supply "that" sound.

I recently witnessed a sad case of neglect with mains wiring, not attended to by a previous technician. Most of these amplifiers have a "voltage select" switch on the rear panel, as well as switches, fuse holder, etc. This amplifier had vaporised most of the valve filaments as a result of (I can only gather) "knob twiddling" when the thing didn't work. It didn't work because the wire feeding the mains fuse had come adrift, to arc on the adjacent switch contact. I hate to think of the consequences had the system not been properly earthed.

In every one of these I get, I arm myself with the wire cutters, new cable and heatshrink tubing. I completely isolate the connections to the switch, including the transformer taps, and just connect up to the 240V tap. I then tuck away any unused wiring after insulating the ends with the heatshrink, before checking all other wiring with particular reference to the earth connection. The old insulation on these switches is very much suspect and I do not trust them one little bit (same goes for old radios with voltage select functions).

I also appreciate your editorial in the July 1993 issue – it says so much and I agree all the way. I recently purchased the old "Miniwatt" val manual for $15.00. I won't part wi it. I have a laugh when I think I cou have had one for 25 shillings, bu used to borrow or ask someone for t loan of theirs, back in those wonde ful days.

When do you think the old "tra sistor" radios will become collector items? I have a few of these and som of them seem worthy of restoratio especially for their shortwave capabil ties. (L. T., Eaglehawk. Vic).

• While there is a difference betwee the published PC board layout an the circuit for the IF calibration oscil lator, it will work either way since th 1.5kΩ resistor only has the effect o slightly reducing the drive to the crys tal.

Wants woof level for Woofer Stopper

I have completed the "Woofer Stopper" project in the May 1993 issue of SILICON CHIP. Would you kindly let me know what voltage I can expect at the speaker terminals? At the moment it is 7V AC. Thank you for a first class magazine. (A. B., Young, NSW).

• The voltage across the speaker terminals will be around 9V or 10V AC. However, that will depend largely on the frequency response of your multimeter. Most multimeters do not have a good response to 20kHz and so you can expect a reduced reading. In other words, 7V AC is probably about right for your multimeter.

Higher input voltage for 2kW inverter

I have been interested in wind powered alternators and associated power systems for some time. After some consideration, one must conclude that the currently available solutions leave a lot to be desired since the general usage is to run the system with an inverter to give 240VAC. It also makes a lot of sense to have the DC side of the system at the highest voltage prac-

Modifications to SLA battery charger

I'm building the SLA charger as featured in the July 1992 issue of SILICON CHIP and was wondering if you could scrawl a "quick-n-dirty" diagram showing where two LEDs could be placed to indicate "on charge" and "full" or "trickle" – maybe even a dual-colour LED.

Also I intend to have a switch to change the output to give 6.9V. Is this output OK to charge a 6V SLA battery? (P. N., West Wyalong, NSW).

• Since this circuit is essentially a constant voltage regulator, it is not possible to have LEDs which show charge and trickle modes. All you can do is connect a LED across the output of the charger in series with a 4.7kΩ resistor which will indicate that the unit is on. If you want to charge 6V batteries, you will need to delete the 2.2kΩ resistor at pin 5 and use a parallel combination of 5.1kΩ and 100kΩ instead.

. It's hard to estimate what this ld be but I would guess 72-112V. ; greatly reduces the input current the problems associated with it. cost of batteries is also reduced as can use 12V heavy duty automo- types.

have studied your articles on the V sinewave inverter. It would ap- r that the input section could be esigned to allow for a higher input tage. I don't have the design skill do this as I am a mechanical engi- er. The only problem I see is the gher voltages involved, this being ndled by IGBTs. (B. B., Warrnam- ol, Vic).

Before we started designing the 2kW verter, the question of what voltage ould be used to supply the inverter used much discussion. Obviously, high initial voltage to work from ould solve many problems and pro- ide higher efficiency. However, it was oncluded that any voltage above 24V ould render the inverter impractical or many users who would want to un it from their vehicle batteries.

For the alternative power user who an connect any number of batteries n series, an inverter which runs from a higher voltage is a practical proposi- tion. In fact if the DC voltage was 360V, then no step-up inverter would be required. You could simply just use the sinewave portion of the 2kW inverter. This high voltage is rather dangerous though and the extra pre- cautions required to protect people from electric shock from the batteries would add to the cost.

A more practical input voltage for the DC-DC inverter would be around 120V. The current drawn from the inverter would be reduced by a factor of five to only 20A compared to our original design operating from 24V. The changes necessary for the higher voltage involve changing the trans- former windings, changing Mosfets Q5-Q16 for higher voltage types, and changing the zener diode voltage for ZD2 and ZD4. The 8 x 10µF 63VW capacitors at the DC input to trans- former T1 will also need changing to higher voltage types. In fact, these changes require some careful redes- ign.

To change the transformer, the pri- mary windings will need 1 turn each for every 24V increase in supply. If 120V is used, the primary will have 10 turns. The secondary will need a reduction in turns for 360V output. Make sure that the gauge of winding wire has no more that 5A per square mm in both primary and secondary windings.

If a 120V supply is to be used, the recommended replacement for Q5- Q16 is the Philips BUK437-400A which has a 400V 14A rating. ZD2 and ZD4 should be rated at 300V at 3W. However, the above information really only gives the "broad brush" changes which would be needed. In fact, you are looking at a complete redesign and this could take several hundred man-hours.

Better crossover for a cheap loudspeaker

Over several years (due to very limited income) I have established a fairly reasonable hifi system. I feel the main flaw in the system is the speakers and wish to upgrade. Currently I am using a pair of cheap "Masuda" 3-way speakers rated at 60W. I have also recently obtained a pair of Teac surround speakers rated at 30-60W. Driving these speakers is a Kenwood 100W re- ceiver. The sound reproduction is satisfactory, however I feel that the system is capable of a much im- proved performance.

An investigation into the com- ponents of my speakers indicated a fairly rudimentary setup. The drivers appear to be reasonable, however the crossover network is hardly satisfactory. The network simply consists of a capacitor in line with the tweeter and midrange (2.2µF and 8µF respectively) and an inductor in line with the woofer, thus producing a simple 6dB/oc- tave filter.

What I would like to know is how to maximise the performance of these components. Is it worth upgrading to a 12dB/octave crosso- ver, or should I just replace the entire system with a driver kit? As for the surround speakers, is there a surround sound decoder avail- able (even in kit form) which would suit this system? As a modifica- tion or alternative, would the ad- dition of a subwoofer be justified with 10-inch drivers already in- corporated in the main system?

I mainly use this system in an enclosed space but it is also often used in an open, party situation where an intensity of up to 100dB is often achieved. Not far after this, I am presented with ugly distor- tion. 100dB is achieved at approxi- mately half volume and distortion sets in at about three-quarter vol- ume. Is such distortion expected from 60W speakers driven by a 50W per channel amplifier?

I hope you can supply me with some suggestions in order to en- hance my system. (J. D., Blackburn South, Vic).

• We do not think you will gain much improvement by changing the crossover to a 12dB/octave net- work, since the quality of your driv- ers may not justify having a better network. If you can afford it, the best solution is to upgrade to a better loudspeaker system. In gen- eral, choose the best 2-way system you can afford, rather than a bigger 3-way system which will gener- ally have lesser quality drivers for the same money.

The symptoms of distortion which you obtain above the "half volume" setting are most likely due to overload in your speakers or amplifier. Either way, you should not exceed this setting because you run the risk of burning out your tweeters, at the very least. This situation is very common and many people damage their speak- ers in this way.

The fact is that a speaker rated at 60 watts may be easily overloaded by an amplifier which is capable of only 50 watts. This is because speaker power ratings are nominal and often inflated in the case of cheaper loudspeaker systems. Sec- ondly, any amplifier which is driven well into clipping (ie, over- load) will deliver far more than its ratings suggest, although the sound quality will be horribly distorted. It is this excess power which blows speakers, especially tweeters.

So if your speakers make horri- ble sounds above a certain volume setting, you are being warned of impending damage.

Wrong connection for low fuel indicator

I recently purchased a Low Fuel Indicator Kit as published in the February 1993 issue of SILICON CHIP and I installed it according to the instructions, checking everything out with a multimeter, etc. I have a Holden Barina (1991 Model) which has the fuel gauge constant. It does not work through the ignition, so I installed the kit direct from the battery with a switch to turn it off when the red light comes on. Now what is happening is that when I switch on, the red light comes on continuously even when you turn the 'pot' around.

It is definitely connected to the correct sensor wire in the car. Any clues? (R. C., Reservour, Vic).

• We assume that when you say your Barina has the fuel gauge "constant", you mean that the fuel gauge continues to indicate the fuel level in the tank even after the ignition is turned off. This is a common feature of Japanese late model sedans but the fuel gauge is still connected via the ignition switch.

What happens is that there is a gel damping system inside the meter which maintains the reading when power is removed – the fuel gauge will continue to show its last reading even if the battery is disconnected.

If you want proof of this, go to your local petrol station and fill the car's tank. Then look at the fuel gauge before you restart the engine – the gauge will still show the fuel level before you filled the tank. Once you start the car, the pointer will move up to the full tank mark.

What this means is that you should connect the low fuel indicator via the ignition switch, as specified in the article. Once you do that, it should work properly.

Microprocessors temporarily unavailable

I'm currently building the Remote Volume Control for Hifi Systems presented in the May and June issues of SILICON CHIP magazine. I have had difficulties hunting for IC7 (AD7112-CN) in this particular circuit. Could you tell me where I can get this IC and how much will it cost. I would also want to know if the microprocessor ICI (MC68HC705C8P) is still available for purchase. (T. L., No address).

• The AD7112CN is available from NSD Australia. In NSW, phone (02) 646 5255: in SA, phone (08) 211 849; Qld, (07)854 1911; and in Victoria, (03) 890 0970. We currently have no stocks of the MC68HC705C8P and with the world-wide shortage of semiconductors, we are not expecting further stocks for several months. When we have them back in stock, we will advertise them.

Manual wanted for Tektronix scope

I have purchased SILICON CHIP for several years now and find it most enjoyable and informative. As an invalid hobbyist, I have purchased kit test equipment where possible. I did lash out and buy an old Tektronix 545B scope with a CA type plug-in unit which is a 2-channel 24MHz unit. My hope is that one of your readers may have an operator's handbook or service book for this 545B oscilloscope that they no longer need or would be prepared to copy.

I would gladly pay for copying and postage of same. I would also be prepared to pay a reasonable sum for an original manual. Although physically very large, the scope is very good for my needs when working properly. (D. Gardner, 8 Harris St, Castlemaine, Vic 3450).

Offset voltage query for equaliser

I am writing to you regarding a problem I am having constructing one of your project designs – the Studio Series 20-Band Stereo Equaliser described in the August 1989 issue of SILICON CHIP. The outputs of ICs 3-7 all have DC offsets very close to zero. However, the outputs of ICs 1 & 2 (pins 1 & 7) all have DC offsets of between 37mV and 41mV (with supply voltages of -14.99V and +15. and no input signal).

Replacing the supplied ICs v Motorola LM833s gave the same sets. After disconnecting the inp and outputs of IC1 from the circu obtained the following: roughly 3 at the non inverting inputs and 14\ the inverting inputs and outputs.

The only explanation I can think is that these values are a result of t proximity of the ICs to other comp nents. Any help that you could gi me in solving this problem would much appreciated. (N. T., Turramur NSW).

• According to our calculations, tl output offset voltage for the LM83 in this circuit should typically b +50mV due to the input bias curre via the 100kΩ resistor at pin 5 (or pi 3). In fact, prompted by your letter, w measured the offset voltage of th LM833 in our prototype 32-ban equaliser which uses a very simila circuit. The offset voltage was +48mV

With this in mind, it appears tha the DC offsets in your equaliser are a little better than typical. Such offsets will not cause any problems. We trust that you are only concerned because our voltage checking procedure in the September 1989 issue makes the remark that the "voltage in each case should be within a few millivolts of 0V". We should have said "within 100mV of 0V in the case of the LM833s". We apologise for the confusion this may have caused you.

Multi-turn pot for power supply

Can you tell me the correct value for the multi-turn pot (VR4) used in the dual tracking power supply published in the April 1990 issue. The schematic indicates 10kΩ but the parts list indicates 5kΩ. Which value is correct? What effects would flow from an incorrect value?

In some circumstances, I will want to recalibrate the upper limit to 30V to avoid accidental damage to prototype circuits. Will the design values allow this? If not, what adjustments to component values would be needed? (P. L., Osborne Park, WA).

• VR4 should be 5kΩ. To set the maximum output to 30V, change the 15kΩ resistor in series with VR2 to 3.3kΩ and adjust VR2 to get a 30V output, as set out in the article. SC

MARKET CENTRE

Cash in your surplus gear. Advertise it here in Silicon Chip.

ANTIQUE RADIO

ANTIQUE RADIO RESTORATIONS: Specialist restoration service provided for vintage radios, test equipment & sales. Service includes chassis rewiring, recondensering, valve testing & mechanical refurbishment. Rejuvenation of wooden, bakelite & metal cabinets. Plenty of parts – require details for mail order. About 1200 radios within 16,000 square feet. Two-year warranty on full restoration. Open on Saturday 10am-4.30pm; Sunday 12.30-4.30pm. 109 Cann St, Bass Hill, NSW 2197 Phone (02) 645 3173 BH or (02) 726 1613 AH.

FOR SALE

WEATHER FAX programs for IBM XT/ATs *** "RADFAX2" $35 is a high resolution, shortwave weather fax, Morse & RTTY receiving program. Suitable for CGA, EGA, VGA and Hercules cards (state which). Needs SSB HF radio & Radfax decoder. *** "SATFAX" $45 is a NOAA, Meteor & GMS weather satellite picture receiving program. Needs EGA or VGA plus "WEATHER FAX" PC card. *** "MAXISAT" $75 is similar to SATFAX but needs 2Mb expanded memory (EMS 3.6 or 4.0) and 1024 x 768 SVGA card. All programs are on 5.25-inch or 3.5-inch disks (state which) & include documentation. Add $3 postage. Only from M. Delahunty, 42 Villiers St, New Farm, Qld 4005. Phone (07) 358 2785.

NE602 $3.50, BF981 $1.50, BC549c $0.18, BC547/557 $0.15 ea, BC327/337 $0.22 ea. Send name and address and I will put you on my mailing list. Goodwin Electronics, PO Box 31081, Christchurch, New Zealand. Visa, Mastercard, Bankcard accepted. Postage $5 Australia/Pacific, $4 NZ.

68705 MICRO EMULATOR!!!: Yes! A fair dinkum 68705 hardware ICE for $285 (B&T $330). Run programs in RAM, built-in disassembler, single step, break points, the works! It even emulates 2716, 2732 and 2764 EPROMs. Can be used with a PC, MAC etc. Optional 687053/U/R ($115) and C4/C8 ($95) programmers for direct connection to 68705 emulator. Kits and further info from Graham Blowes, Mantis Micro Products, 38 Garnet St, Niddrie 3042. Phone (03) 337 1917(ah), (03) 575 3349(bh), fax (03) 575 3369.

CUSTOMERS REQUIRED. No previous experience necessary. 100% Australian 8K-4Mb DIP or SIMM Printer Buffer Short Form Kit. Includes Z80 Source and ROM files. $38. With EPROM $52. Don McKenzie, 29 Ellesmere Crescent, Tullamarine 3043. Phone (03) 338 6286.

FOR SALE: Inter Venture Logic Bridge Model 136 (see SC Feb. 1993). Won as prize. Never used. Value $690. Sell $400 or n/o. Contact Barry Flanigan, 2 Daly Ct, Churchill 3842. Phone (051) 22 1321.

SATELLITE RECEIVER: Winersat WR-920 PLL, 66 channels, infrared remote, video/audio. IFs are adjustable. Includes position steering facilities (in excellent condition.) $400.00. Phone Rod (08) 387 0372.

SATELLITE RECEIVER: NEC 4GHz commercial unit. Intelsat/Palapa use. $180.00 o.n.o. Phone Rod (08) 387 0372.

THE HOMEBUILT DYNAMO: (plans) brushless, 1000 DC watt at 740 revs. $A85 postpaid airmail from Al Forbes, PO Box 3919 - SC, Auckland, NZ. Phone Auckland (09) 818 8967 any time. Rotor magnets (3700 gauss) kit now available.

CLASSIFIED ADVERTISING RATES

Advertising rates for this page: Classified ads: $10.00 for up to 12 words plus 50 cents for each additional word. Display ads (casual rate): $20 per column centimetre (Max. 10cm). Closing date: five weeks prior to month of sale.

To run your classified ad, print it clearly on a separate sheet of paper, fill out the form below & send both with your cheque or credit card details to: Silicon Chip Classifieds, PO Box 139, Collaroy Beach, NSW 2097. Or fax the details to (02) 979 6503.

Enclosed is my cheque/money order for $_____ or please debit my

❑ Bankcard ❑ Visa Card ❑ Master Card

Card No. | | | | | | | | | | | | | | | |

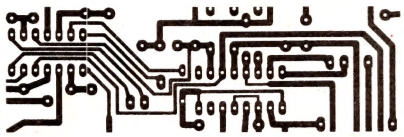
Signature_____ Card expiry date_____/_____

Name _____

Street _____

Suburb/town _____ Postcode_____

RCS RADIO PTY LTD



RCS Radio Pty Ltd is the only company that manufactures and sells every PC board and front panel published in SILICON CHIP, ETI and EA.

RCS Radio Pty Ltd,
651 Forest Rd, Bexley 2207.
Phone (02) 587 3491

SECONTRONICS
COMPONENTS, COMPUTERS, ELECTRON TUBES
S/H TEST EQUIPMENT, COMPUTER REPAIRS

WESTERN DIGITAL HD 170Mb 13ms $395
I/O + IDE/FDD $35 **RESISTORS**
AT I/O CARDS $22 **MOST VALUES AVAIL.**

2SD1169	$2.00	1/3W CARBON	$2/100
2N3440	$0.80	1/2W CARBON	$4/100
2N3439	$0.80	1W CARBON	$5/100
2SC3157	$4.00	2W CARBON	$8/100
27C41	$0.80	5W WIREWOUND	$0.30
7406	$0.20	10W RESISTORS	$0.60
8250 $5	8251 $2	8259 $2	6809 $8

KB 327OPC KEYBOARDS, 3 ONLY, $110.00 ea

VALVES:		QQV07/50	$25	ECF80	$6
12AU7	$6	12AU7A	$7	12AU7WA	$9
1S2	$3	1T4	$6	CV553	$3
2C39A	$30	2C40A	$40	3A4	$8
5651	$6	5651A	$6	4-400A	$80
6J6WA	$7	QB3/300 (10 ONLY)	$145 ea		

SPECIAL: SURFACE MOUNT COMPONENT PACK – 180 RESISTORS, 40 ZENERS, 30 TRANSISTORS AND 2 ICs. $6.50 INC. PACK & POST
PHONE OR MAIL ORDERS, CREDIT CARDS ACCEPTED FOR ORDERS $20 & OVER, DISCOUNTS FOR QUANTITY ORDERS.
NOW AT SHOP 5, 79 RICKSTON ST, MANLEY WEST, QLD. 4179.
OPEN TUES - FRID 9.30AM - 5PM, SAT. 9AM - 2PM.
MAIL ORDERS TO PO BOX 34 CANNON HILL QLD. 4170.
PHONE (07) 396 1859, FAX (07) 855 1014.

TRANSFORMER REWINDS
ALL TYPES OF TRANSFORMER REWINDS
TRANSFORMER REWINDS
Reply Paid No.2, PO Box 438, Singleton, NSW 2330. Ph: (065) 76 1291. Fax: (065) 76 1003.

ELECTRONIC CAD FOR DOS
Zeus 2000SCH: $150 Parts Database: $30
Zeus 2000PCB: $200 Micro PCB: $80
Payment by cheque/mo. Add $5 postage.
G. A. GEORGOPOULOS
34 Scouller St, Marrickville, NSW 2204.

MEMORY & DRIVES
PRICES AT NOVEMBER 1ST, 1993

SIMM			**IBM PS.2**		
1Mb x 3	70ns	$70	50/55/70	2Mb	$160
1Mb x 9	70ns	$82	70/35	4Mb	$320
4Mb (72-pin)		$320	90/95	4Mb	$320
4Mb x 9	70ns	$250			
4Mb x 8	80ns	$230	**TOSHIBA**		
			T3200SX	4Mb	$360
DRAM DIP			T44/6400	4Mb	$340
1 x 1Mb	70ns	$10	T5200	8Mb	$680
256 x 4	70ns	$8			
1Mb x 4	Z	$35	**MAC**		
			2Mb SI & LC		$130
DRIVES			4Mb P'Book		$330
SEAG 42Mb	28ms	$190			
SEAG 107Mb	15ms	$285	**CO-PROCESSORS**		
SEAG 130Mb	16ms	$290	387SX to 25		$105
SEAG 214Mb	16ms	$355	387DX to 33		$105
SEAG 528Mb	12ms	$985	**Laser PTR HP**		
			with 2Mb		$203

Sales tax 21%. Overnight delivery. Credit cards welcome.
Ring for Latest Prices
1st Floor, 100 Yarrara Rd, PO Box 382, Pennant Hills, 2120.
Tel: (02) 980 6988
Fax: (02) 980 6991
PELHAM

ICL 286 Board
All in one board with two serial, printer, IBM keyboard, high density floppy & IDE mono video interface. Up to 4Mb RAM, 80286-16cpu, MS-DOS compatible, 130 page manual, small size 170mm x 255mm.
$299

Ampo little PC
All in one NEC V40 CPU board, MS-DOS compatible, high density floppy. SCSI hard disk, 2 serial, printer, solid state hard disk, IBM keyboard interface, (4W), CMOS single +5V rail, up to 768Kb RAM, 384Kb ROM, 145mm x 250mm, 98-page manual. **$299**

Kits
Max I/O kit for PCs, 7 relays, ADC, DAC, stepper driver, TTL inputs, with software **$169**
PC I/O card with 8255 chip 24 I/O lines programmable as inputs or outputs **$69**
1.5 watt AM broadcast transmitter XTAL locked **$49**
2.5 watt FM broadcast transmitter 88-108MHz. **$49**
Digi-125 audio power amp (over 19,000 sold since 1987) 50 watt/8 **$14** 125 watt/4 **$19**
New 200 watt/2 version **$29**
Infrared relay kit **$9**
Remote control tester **$4**

P.C. Computers 36 Regent St, Kensington, SA. Phone (08) 332 6513.

Advertising Index

All Electronic Components 89
Altronics 26-28
Antique Radio Restorations 95
A-One Electronics 38-39
Contan Audio 87
David Reid Electronics 59
Dick Smith Electronics 12-15
D & K Wilson Electronics 61
Emona 11
Harbuch Electronics 59
Jaycar 45-52
JV Tuners 61
Oatley Electronics 3
PC Computers 96
Pelham 96
Peter C. Lacey Services 56
Philips Test & Measurement .. OBC
RCS Radio 95
Resurrection Radio 73
Rod Irving Electronics 74-79
Secontronics 96
Silicon Chip Back Issues 82-83
Silicon Chip Book Club 69
Silicon Supply & Manufacturing .. 7
Technical Applications 61
Transformer Rewinds 96
Yokogawa ..... IFC

SUBSTITUTE FOR A HANDFUL OF ICs: Parallax "BASIC STAMP". A general purpose small circuit module, it is really a 25 x 50mm board with a computer chip (4MHz PIC 16C56), EEPROM, 8 I/O pins, board space includes prototyping area. Program it on a PC (only 33 instructions) with development kit which includes one "BASIC STAMP" ($249 plus S/T & post), extra modules ($66 plus S/T & post). Send 45c stamp for more information. Parallax distributor and technical support in Australia: MicroZed Computers, PO Box 634, Armidale, NSW 2350. Facsimile (067) 72 8987. **MICASOFT** Electronics and Computing tutor program, written in UK, ideal for TAFE, schools, or individual use. Now available in Australia. Send $1.80 in stamps for demo disk (tell us what size). MicroZed Computers, PO Box 634, Armidale 2350.

NICAD BATTERY Charger Conditioner Analyser. As featured in SILICON CHIP. September 1993. Complete kit $135.00. Built and tested $185. P&P $10. C.I.E., 524 Abernethy St, Kitchener, NSW 2165. Phone (049) 91 1389.

UNUSUAL BOOKS: Electronic Devices, Fireworks, Locksmithing, Radar Invisibility, Surveillance, Self-Protection, Unusual Chemistry and more. For a complete catalog, send 95 cents in stamps to Vector Press, Dept S, PO Box 434, Brighton, SA 5048.

PAY TV & SATELLITE Scrambling News Monthly, with the latest on descrambling techniques & addresses, where to buy the latest descramblers. Send stamp for info. John Papp, Box 37885 Winnellie, N.T. 0821.

SPRINKLER CONTROLLER KITS: standard and enhanced versions available. Very reliable and versatile designs control 8 stations and have 32 programmable START and RUN times. These kits use latest technology I^2C chips (refer SILICON CHIP July 1992). All settings stored in EEPROM. Kits come complete with LCD and case. Standard version $135 incl. p&p. Enhanced version uses 68705U3 and has built-in calendar, allowing day of fortnight watering, (ie SA, SU, MO, etc), externally triggerable cycles and rain switch software. $175 incl. p&p. Requires 24V AC. Relays extra at $3.75 each (require 9 for full kit). Kits and further info from Graham Blowes, Mantis Micro Products, 38 Garnet St, Niddrie 3042. Phone (03) 337 1917 (AH), (03) 575 3349 (BH). Fax (03) 575 3369.

PRINTED CIRCUIT BOARDS for the hobbyist. For service & enquiries contact: T. A. Mowles (08) 326 5590.

FLUKE AND PHILIPS - THE GLOBAL ALLIANCE IN TEST & MEASUREMENT

FLUKE®

PHILIPS

PHILIPS

70 SERIES II

We've improved on a winner

If you've waited for the next generation digital multimeter technology, you've made the right choice. Now there is the new Fluke 70 Series II. We've made the world's most popular DMM's even better.

At the top of the line, the new Fluke 79 and 29 blend high-performance features – capacitance, frequency, a fast 63-segment bar graph, Lo-Ohms range, Smoothing™, faster ranges – and affordability.

At the entry level, the new model 70, Fluke's lowest-priced DMM ever, delivers unparalleled Fluke quality and safety.

"Basics" Redefined

No matter which 70 Series II you choose, you get simple, one-handed operation. High resolution. And built-in reliability.

Automatic Touch Hold® – standard on every model – locks the reading on the display and signals you with a beep. Leaving you free to concentrate on your work, not on your meter.

There's also fast autoranging. A quick continuity beeper. Diode test. Automatic self-test. Overload protection, even in the 10 amp range. And a sleep mode that automatically powers down the meter when you forget to.

Best of all, every 70 Series II is a Fluke, backed by a worldwide service network and 3-year warranty.

1

Be No. 1 with Fluke and Philips

Available from the following Philips Test & Measurement distributors:

ALL STATES: BEP, Dick Smith Electronics, GEC, Petro-Ject.

NSW: Ames Agency, Auslec, CLC Agencies, Consultant Technologies, David Reid Wholesalers, DGE Systems, Ebson, Elect. Smith Projects, Emcorp, Illawara Ind. Instrumentation, J.Blackwoods & Son, Lawrence & Hanson, Macelec, Novocastrian, Obiat, Stott Ind. Suppl., Tech Fast, Tecnico, Vincom.

ACT: Advanced Instrument Services, Aeromotive Maintenance, John Pope Electrical.

VIC: Auslec, Emcorp, Factory Controls, J. Blackwoods, Parallel Systems, Radio Parts Group.

QLD: Auslec, Colourview Electronics, Emcorp, Industrial & Marine Electrics, J.Blackwoods, L.E. Boughen, Mass Electronics, Nortek, Solex, St. Lucia Electronics, Thomson Instruments.

S.A: A.W.M. **TAS:** George Harvey.

W.A: Atkins & Carlyle, Leda Electronics, R.S. Components.

N.T: Industrial Suppliers & Switchgear J.Blackwoods.

PHILIPS

PHILIPS

Double-Speed CD-ROM Kit With Four CDs

Includes Software Valued At Over $500*!

With the massive storage capacity of CD-ROM discs, accessing data and programs can take quite a while. Unless, of course, you have a Double-speed CD-ROM drive from Dick Smith Electronics.

Not only is it one of the very quickest drives available, it also supports the new Kodak "PHOTO CD" standard - allowing you to have your snapshots processed onto a CD-ROM disc at very reasonable cost.

Once your photos are on disk, you can view them onscreen, incorporate them into computer-generated graphics, print them out on a suitable printer, in fact, do just about anything you want!

Unlike some other PHOTO-CD compatible CD-ROM drives, the Double Speed drive allows you to acess pictures that have been added since your PHOTO-CD disc was created - why pay for additional discs when there's plenty of room left on your current one!

Upgrade Kit Includes Four Top Educational CD-ROM Discs:
"Just Grandma And Me"
"Where In The World Is Carmen Sandiego Deluxe"
"Animals"
"Software Toolworks Encyclopaedia MPC"

Kit includes double speed CD Rom drive, Sound Blaster Pro card, in-built amplifier mixer plus over $500* worth of CD titles.

This has to be the best-value CD-ROM package ever offered!

Cat X-2268
$799

*Based on the recommended shelf prices for these items

Sound Blaster Deluxe Edition

Computers Have Never Sounded Better!

Still the best value in entry-level PC sound cards, this latest version includes improved software and two bonus games. Just about every modern game is happy to play music and sound effects through the Sound Blaster plus, it's super easy to install as your Windows sound device! It also offers: 11-voice Adlib-compatible music synthesiser, voice recording, digital sound sampling and more!

Cat X-2054
$149

Sound Blaster 16-Bit Sound Card

Want The Best In PC Sound?

If you're looking for awesome 16-bit CD-quality sound in your games and Windows applications, this is the sound card for you! It features: Auto dynamic filtering, an enhanced, four operator/20 voice FM music synthesiser with realistic instrument sounds, a 10-channel stereo mixer, tone control and recording input mixer, MIDI and CD-ROM interfaces plus a full library of professional-standard sound processing software. We don't have room to list it all here, but you'll have to hear it to believe it, anyway!

Cat X-2062
$349

For the location of your nearest store or to place an order, call
SYDNEY AREA 888 2105
Outside Sydney (Free Call)
008 22 6610
Or Fax: (02) 805 1986

DICK SMITH ELECTRONICS